



Calhoun: The NPS Institutional Archive

Theses and Dissertations

Thesis Collection

2003-09

The XM777 joint lightweight 155mm Howitzer program (LW155): case study in program management considerations concerning the use of national arsenal assets



Calhoun is a project of the Dudley Knox Library at NPS, furthering the precepts and goals of open government and government transparency. All information contained herein has been approved for release by the NPS Public Affairs Officer.

Dudley Knox Library / Naval Postgraduate School
411 Dyer Road / 1 University Circle
Monterey, California USA 93943

<http://www.nps.edu/library>



NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

MBA PROFESSIONAL REPORT

The XM777 Joint Lightweight 155mm Howitzer Program (LW155):
A Case Study in Program Management Considerations
Concerning the Use of National Arsenal Assets

By: Philip R. Clark
September 2003

Advisors: David F. Matthews
Raymond E. Franck

Approved for public release; distribution is unlimited.

THIS PAGE INTENTIONALLY LEFT BLANK

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington DC 20503.				
1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE September 2003		3. REPORT TYPE AND DATES COVERED MBA Project
4. TITLE AND SUBTITLE: The XM777 Joint Lightweight 155mm Howitzer program (LW155): A Case Study in Program Management Considerations Concerning the Use of National Arsenal Assets			5. FUNDING NUMBERS	
6. AUTHOR: Philip R. Clark			8. PERFORMING ORGANIZATION REPORT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000			10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A			11. SUPPLEMENTARY NOTES The views expressed in this project are those of the author and do not reflect the official policy or position of the U.S. Department of Defense or the U.S. Government.	
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution is unlimited			12b. DISTRIBUTION CODE	
13. ABSTRACT (maximum 200 words) The end of the Cold War signaled hard times ahead for both public and private manufacturers in the Nation's Defense Industry. Army-controlled manufacturing Arsenals, subject to Governmental control and requirements to maintain excess mobilization capacity, found themselves increasingly unable to compete with private industry on cost. Set-aside protectionist legislation, especially the Army Arsenal Act and the Stratton Amendments, played an increasing role in the ability of the Arsenals to obtain work. The Army Arsenal Act applies to "make or buy" decisions and the Stratton Amendment restricts the transfer of large-caliber cannon technology to foreign nations. The LW155 Joint Program Office has dealt with both statutes because it manages a multi-national weapon system with a large-caliber cannon and is scheduled for production by the Army. This report uses the LW155 Program as a case study to examine three areas of importance to a Program Manager: the application of the Army Arsenal Act to joint service programs; the prime contractor's ability to control the origin of component parts; and the constraints upon multi-national production caused by the Stratton Amendment.				
14. SUBJECT TERMS: XM777, Joint Lightweight 155mm Howitzer, LW155, Army Arsenal Act, Stratton Amendment, Watervliet Arsenal (WVA), Rock Island Arsenal (RIA)			15. NUMBER OF PAGES 107	
17. SECURITY CLASSIFICATION OF REPORT Unclassified			16. PRICE CODE	
18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified		19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified		20. LIMITATION OF ABSTRACT UL

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. Z39-18

THIS PAGE INTENTIONALLY LEFT BLANK

Approved for public release; distribution is unlimited

**THE XM777 JOINT LIGHTWEIGHT 155MM HOWITZER PROGRAM (LW155):
A CASE STUDY IN PROGRAM MANAGEMENT CONSIDERATIONS
CONCERNING THE USE OF NATIONAL ARSENAL ASSETS**

Philip R. Clark
Captain, United States Army
B.S., United States Military Academy, 1993

Submitted in partial fulfillment of the
requirements for the degree of

MASTERS OF BUSINESS ADMINISTRATION

from the

**NAVAL POSTGRADUATE SCHOOL
September 2003**

Author:

Philip R. Clark

Approved by:

David F. Matthews
Lead Advisor

Raymond E. Franck
Support Advisor

Douglas A. Brook
Dean, Graduate School of Business and Public
Policy

THIS PAGE INTENTIONALLY LEFT BLANK

ABSTRACT

The end of the Cold War signaled hard times ahead for both public and private manufacturers in the Nation's Defense Industry. Army-controlled manufacturing Arsenal, subject to Governmental control and requirements to maintain excess mobilization capacity, found themselves increasingly unable to compete with private industry on cost. Set-aside protectionist legislation, especially the Army Arsenal Act and the Stratton Amendments, played an increasing role in the ability of the Arsenal to obtain work. The Army Arsenal Act applies to "make or buy" decisions and the Stratton Amendment restricts the transfer of large-caliber cannon technology to foreign nations. The LW155 Joint Program Office has dealt with both statutes because it manages a multi-national weapon system with a large-caliber cannon and is scheduled for production by the Army. This report uses the LW155 Program as a case study to examine three areas of importance to a Program Manager: the application of the Army Arsenal Act to joint service programs; the prime contractor's ability to control the origin of component parts; and the constraints upon multi-national production caused by the Stratton Amendment.

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

I.	INTRODUCTION	1
A.	BACKGROUND	1
B.	PROJECT PURPOSE	2
C.	RESEARCH QUESTIONS	2
D.	SCOPE AND LIMITATIONS	3
E.	ASSUMPTIONS	3
F.	METHODOLOGY	4
G.	BENEFITS OF STUDY	5
H.	ORGANIZATION OF STUDY	5
II.	BACKGROUND	7
A.	INTRODUCTION	7
B.	THE LW155 PROGRAM	8
1.	The Program	8
2.	Schedule	10
3.	Cost	12
4.	Performance	15
5.	Summary	16
C.	THE ARMY ARSENAL ACT AND THE STRATTON AMENDMENT ...	16
1.	The History of Arsenals	16
2.	The Army Arsenal Act	17
3.	The Stratton Amendment	19
III.	PRESENTATION OF DATA	21
A.	INTRODUCTION	21
B.	LAWS, POLICIES AND REGULATIONS	21
1.	Executive Policy	21
2.	Depot Legislation	22
3.	Army Policy Concerning the Arsenal Act	23
C.	ARSENAL CAPACITY AND WORKLOAD ISSUES	25
D.	THE PROGRAM AND THE LEGISLATION	27
1.	Litigation	27
a.	<i>The Solicitation</i>	27
b.	<i>Army Production</i>	29
2.	Components	31
3.	Foreign Involvement	34
IV.	ANALYSIS	39
A.	INTRODUCTION	39
B.	THE MACRO-LEVEL: A CHANGING ENVIRONMENT AFTER THE COLD WAR	39
1.	Competing Stakeholders	40
2.	The Downward Spiral for Arsenals	42

3.	The Result	43
C.	THE BRIDGE FROM MACRO-LEVEL TO MICRO-LEVEL	44
D.	THE MICRO-LEVEL: THE ARSENAL ACT, THE STRATTON AMMENDMENT, AND THE PROGRAM	48
1.	Litigation	48
a.	<i>The Interaction</i>	48
b.	<i>The Reaction</i>	49
c.	<i>The Results and the Ramifications</i>	49
2.	Components	52
a.	<i>The Interaction</i>	52
b.	<i>The Reaction</i>	53
c.	<i>The Results and the Ramifications</i>	53
3.	Foreign Involvement	54
a.	<i>The Interaction</i>	55
b.	<i>The Reaction</i>	56
c.	<i>The Results and the Ramification</i>	57
d.	<i>The Primer Feed Mechanism (PFM)</i>	59
e.	<i>BAE Systems' Answer to the Stratton Amendment</i>	60
V.	CONCLUSIONS AND RECOMMENDATIONS	63
A.	CONCLUSIONS	63
1.	Primary Research Question Review	63
2.	Subsidiary Questions Review	65
B.	RECOMMENDATIONS	73
C.	POTENTIAL AREAS FOR FURTHER RESEARCH	74
	APPENDIX A. GLOSSARY OF ACRONYMS	75
	APPENDIX B. THE STRATTON AMENDMENT	79
	LIST OF REFERENCES	85
	INITIAL DISTRIBUTION LIST	91

LIST OF FIGURES

Figure 1. Reported Arsenal Workload Levels for Fiscal Years 1988 through 1998 [Ref. 9: p. 57]	46
Figure 2. Capacity Utilization at RIA from FY1988 to 1998 as a Percentage of Total Manufacturing Capacity Available [Ref. 9: p. 57]	47

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF TABLES

Table 1.	XM777 Projected Performance Improvements [Ref. 19: p. 6]	9
Table 2.	Comparison of Key Program Milestones Since the Original Schedule	12
Table 3.	Increases in Estimated Development and Production Costs of Howitzer and TAD	13
Table 4.	Estimated Percentage of Total Manufacturing Capability Utilized at RIA and WVA [Ref. 9: p. 57]	25
Table 5.	Reported Arsenal Workload and Employment Levels at RIA for Fiscal Years 1988 Through 1998 [Ref. 9: p. 57]	26
Table 6.	Planned Purchase from BAE Systems with Army BCTs Included as of July 2002 [Ref. 15: p. 14]	37
Table 7.	Planned Purchase from BAE Systems without Italians or Army BCTs [Ref. 15: p. 14]	38
Table 8.	Summary of Arsenal Act and Stratton Amendment Interaction with LW155 Program.	72

THIS PAGE INTENTIONALLY LEFT BLANK

ACKNOWLEDGEMENTS

I would like to extend my deepest thanks to Mr. James Shields and Mr. Martin Kane of the XM777 Joint Lightweight 155mm Program Office (LW155). I would have been lost without their help in providing program-specific documentation and their willingness to candidly provide their opinions and perspective concerning the events outlined in this case study. Additionally, I would like to thank Mr. Robert Parise of the U.S. Army Armament Research, Development, and Engineering Center (ARDEC) Legal Office for his help in answering legal questions and providing legal documentation.

THIS PAGE INTENTIONALLY LEFT BLANK

I. INTRODUCTION

A. BACKGROUND

The end of the Cold War and the demise of the Soviet Union signaled the closing stages of a period of abundance for both public and private manufacturers in the Nation's defense industry. The "peace dividend" resulted in a defense budget reduced to its lowest level, as a percentage of Gross Domestic Product, since before World War II [Ref. 54: p. 24]. When work had been plentiful, the allocation of work between private industry and the arsenals had not created problems. However, as available defense manufacturing work began to dwindle, the arsenals found their bureaucratic ties to the Government made them less efficient than private industry. This, coupled with the Defense Department's gravitation toward outsourcing associated with Acquisition Reform and the focus on fiscal responsibility, led to loss of work for arsenals at an alarming rate [Ref. 9: p. 56-59].

In 1920, the U.S. Congress enacted legislation, known today as the Army Arsenal Act, designed to protect the Nation's manufacturing arsenals from sitting idle if they could perform work as efficiently as private sources [Ref. 50: p. 6-7]. In 1986, the Congress enacted similar protectionist legislation, known as the Stratton Amendment, to safeguard the arsenals from the export of proprietary large-caliber cannon tube technology for manufacture in other countries [Ref. 28: para. (a)].

The XM777 Joint Lightweight 155mm Howitzer (LW155) Program was a joint venture between the Marine Corps and

the Army established in the mid 1990's [Ref. 15: p. 2-3]. As a weapon system program that involved both the Army and a large-caliber cannon, the Joint Program Office (JPO) found itself confronted with both Army Arsenal Act and Stratton Amendment issues [Ref. 36].

B. PROJECT PURPOSE

This project will explore both the basis for and impacts of the decisions made by the JPO concerning use of National Arsenals. This project will provide Program Managers (PMs) with a case study resource for similar decisions. It provides a history of the LW155 Program, our National Arsenals, the Army Arsenal Act, and the Stratton Amendment. It then explores in detail the points where the Act and the Amendment have interacted with the LW155 program. It then analyzes why, at the policy level, these interactions occurred; the JPO's reaction each time they were faced with decisions regarding the legislation; and the results and ramifications of their decisions. Finally, it recommends ways that PMs can better prepare themselves to deal with the implications the Act and the Amendment.

C. RESEARCH QUESTIONS

In order to accomplish the purpose of this project research, the following primary and subsidiary research questions were established:

1. Primary Research Question

What is the impact of the Army Arsenal Act (10 U.S.C. 4532) of 1920 and the Stratton Amendment (10 U.S.C. 4542) of 1986 upon the development and procurement of Department of Defense (DoD) Weapon Systems such as the LW155?

2. Subsidiary Research Questions

- a. What is the XM777 Joint Lightweight Howitzer Program?
- b. What are the Army Arsenal Act and the Stratton Amendments?
- c. On what occasions have the Army Arsenal Act and the Stratton Amendments affected the LW155 Program and why, how did the JPO react, and what were the ramifications on the program of their reactions?

D. SCOPE AND LIMITATIONS

The project addresses the impact of the Arsenal Act and the Stratton Amendment on DoD programs in general and the LW155 Program in particular. It reports the positions and the actions taken by the JPO in response to the restrictions outlined in both the Arsenal Act and the Stratton Amendment. It attempts to trace "cause and effect" relationships between actions by stakeholders in the Nation's arsenals and the LW155 JPO.

This researcher is a program management student and the purpose of this study is ultimately to determine program management considerations for utilizing National Arsenals. As such, the bulk of the information is analyzed from a program, not an arsenal, perspective.

E. ASSUMPTIONS

This study assumes that the reader is generally familiar with the Federal Government acquisition process. The study also assumes the reader has a general knowledge of ground combat weapon systems and artillery weapon systems.

F. METHODOLOGY

This project first provides a background of the LW155 Program, the history of arsenals, the Army Arsenal Act, and the Stratton Amendment. It then presents a review of the laws, policies, and regulations that address protection of Government industrial assets followed by a comprehensive review of occasions where the Program, the Act, and the Amendment have interacted. These facts are necessary to understand their influence on the JPO's decision-making process. The research then transitions to an analysis of (1) why the interaction between the program and the legislation occurred, (2) the JPO's reaction, and (3) the ramifications on the program of their reactions. In order to fully answer these questions, the analysis begins by addressing the major changes in the defense industrial base in the post-Cold War environment and then shifts to the specifics of the program. Finally, the author provides recommendations for PMs faced with Army Arsenal Act and Stratton Amendment issues in the future.

This is accomplished through literature research, data collection, and personal interviews including the following:

- Unclassified Department of Defense publications, regulations, and policy memorandums
- Official documentation from the LW155 JPO
- Interviews with LW155 JPO personnel
- Interviews with ARDEC Chief Counsel
- General Accounting Office reports
- Legal decisions from the U.S. Circuit Courts
- Historical reports in defense publications

G. BENEFITS OF STUDY

Program Managers can use the results of this study as a guide when establishing their program's position with respect to the Army Arsenal Act and/or the Stratton Amendment.

H. ORGANIZATION OF STUDY

- Chapter I. Introduction: Identifies the purpose of the project, primary and subsidiary research questions, the methodology and potential benefit of the study.
- Chapter II. Background: An overview of the LW155 Program, the history of arsenals, the Army Arsenal Act, and the Stratton Amendment.
- Chapter III. Presentation of Data: A review of the laws, Government policies and Army regulations related to protectionist legislation in general and the Army Arsenal Act and Stratton Amendment in particular. It then presents GAO report data regarding the decline of manufacturing arsenal capacity utilization and work loading since the end of the Cold War. Finally, it presents the major occasions for interaction between the LW155 program and the legislation in question. These are categorized as (1) the litigation; (2) the purchase of components vs. "System Buy" contracts; and (3) foreign involvement in cannon assembly production.
- Chapter IV. Analysis: Begins with analysis of events resulting from post-Cold War defense downsizing that led to Rock Island Arsenal's eventual accusations of violations of the Arsenal Act by the LW155. It then ends with analysis of program and legislative interaction as outlined in the previous chapter.
- Chapter V. Conclusions and Recommendations: Summarizes the conclusions from the analysis, thus answering the research questions. It also makes recommendations for program managers concerning the Act and the Amendment and

potential effects on their programs. Potential areas for further research are also identified.

II. BACKGROUND

A. INTRODUCTION

The following chapter provides a comprehensive review of the LW155 Program, the Army Arsenal Act, and the Stratton Amendment. Background on the program and the associated legislation is necessary to fully understand their subsequent interaction. The LW155 Program review begins with a description of the system and is followed by a more detailed discussion of the areas of schedule, cost, and performance (SCP) as a method for outlining the life cycle of the program. The background of the Army Arsenal Act and the Stratton Amendment begins with a short review of their recent history and problems faced by Army Arsenals and ends with a review of the history and language of the two pieces of legislation.

The majority of the LW155 Program's SCP difficulties outlined in this chapter were presented by the GAO, at the request of Congress, in their multiple reviews of the program. It is important to note that, while the use of the SCP difficulties is a practical manner of presentation easily understood by most acquisition professionals, it focuses primarily on the problems, rather than the successes of any program. Therefore, it is imperative to mention up front that the LW155 program is a program with many successes. The Program completed a rigorous Operational Assessment (OA) where they successfully validated or sufficiently addressed all of the technical performance issues identified in the GAO Reports. Furthermore, the Program entered the Production and

Deployment Phase of the Acquisition Life Cycle with a positive Milestone C decision in November of 2002.

B. THE LW155 PROGRAM

1. The Program

The LW155 is a Joint Marine Corps and Army towed artillery weapon system designed to provide both close and deep fires to support both Marine Corps and Army maneuver forces. The Marine Corps is responsible for funding the Research, Development, Test, and Evaluation (RDT&E) for the howitzer portion of the system, which is designated by the military nomenclature, XM777. The Army is responsible for funding the RDT&E for the Towed Artillery Digitization (TAD) enhancements [Ref. 24: p. 191]. The Marine Corps acquisition objective is 377 howitzers with an Initial Operational Capability (IOC) date of March 2005. The Army acquisition objective is 273 howitzers with an IOC date of August 2006. The Army has currently funded 233 of the 273 planned systems [Ref. 38]. The Army anticipates, but has not yet funded, fielding an additional 114 howitzers to their Interim Brigade Combat Teams (BCTs) [Ref. 15: p. 14]. The Marine Corps will field the howitzers without the TAD enhancements while the Army plans to wait to field the howitzer and TAD as a complete system [Ref. 15: p. 2]. The LW155 was designed to replace the aging 155mm M198 weapon system. The M198 currently serves as the only cannon fire support system for the Marine Corps and as a Direct and General Support weapon system for the Army's light and interim forces. The planned performance improvements of the XM777 lightweight howitzer over the M198 are listed in the table below:

	M198	XM777
Weight	16,000 lbs	9,000 lbs
C-130 Capacity	1 Howitzer	2 Howitzers
Max Rate of Fire	4 Rds/min	5-8 Rds/min
Range	30 Km (assisted)	30-40 Km (assisted)
Emplacement Time	8 Min	< 3 Min
Displacement Time	11 Min	< 2 Min
Primer Mechanism	Manual Single Round	Auto-primer Feed

Table 1. XM777 Projected Performance Improvements [Ref. 19: p. 6]

The system weight, emplacement, and displacement times are all weapon system Key Performance Parameters (KPPs).¹ The goal of the LW155 Program is to produce and field a weapon system that is lighter weight and creates a smaller logistics footprint than the M198. These characteristics will provide for improved strategic deployment, tactical mobility, and survivability for the LW155 weapon system [Ref. 7: p. 2].

Currently, towed artillery systems, such as the M198, require external survey capability and local unit fire direction support. The TAD system will enable the XM777 to compute ballistics on the gun, navigate while on the move, and self-locate using Global Positioning System (GPS) capabilities [Ref. 19: p. 7]. This technology will provide greater speed and employment flexibility that is similar to that possible with the Army's self-propelled artillery, rocket, and missile systems.

¹ The original KPP for Weight was 9,000 pounds for the howitzer and 500 pounds for the TAD. The KPP was changed to 10,500 pounds with TAD, to coincide with the lift capabilities of the V-22 Osprey. The KPP has since been adjusted to 10,000 pounds. As of the Milestone C Briefing on 8 November 2002, the predicted weight of the howitzer with TAD was just under 9,800 pounds [Ref. 38].

2. Schedule

The Marine Corps in 1993, and the Army in 1994, approved the Mission Needs Statement for the LW155 [Ref. 53 and Ref. 44]. The original Joint Operational Requirements Document (JORD) was approved by both Services in 1995 [Ref. 7: p. 1]. As a result, the Government released the Request for Proposal (RFP) soliciting offers for the LW155 development contract on April 10, 1996. The intent of the acquisition strategy was to leverage the development of existing competitive prototypes. An evaluative nine-month shoot-off phase was initiated at Yuma Proving Ground in April following release of the contract solicitation. Three industrial firms competed in the shoot-off:

- United Defense Limited in partnership with Royal Ordnance of England
- Textron Marine and Land Systems of New Orleans teamed with Vickers Shipbuilding and Engineering, Ltd. of England (VSEL)
- Lockheed Martin Defense Systems

The contract was awarded to the team of Textron and VSEL in March 1997 [Ref. 19: p. 8].

The first major delay to the program occurred in December 1998 when Textron experienced internal management problems so significant that they novated the contract completely to VSEL [Ref. 19: p. 8]. The change in the prime contractor and associated restructuring of the contract resulted in a subsequent delay of 22 months in the production decision, from December 1999, to October 2001, (Ref. 10: p. 8] then another 12 months to October 2002. This also caused an eight-month slip to March 2005 in the Marine Corps Initial Fielding [Ref. 11: p. 3]. Additional

schedule delays in the delivery of developmental howitzers were caused by the need for engineering changes and corrective action to address problems found during manufacturing and initial developmental testing [Ref. 11: p. 5].

The second major program delay occurred in June 2001. The Marine Corps Operational Test and Evaluation Agency (MCOTEA) advised the program office that the developmental guns were inappropriate for Operational Test and Evaluation (OT&E). BAE Systems² planned for, and ultimately did, subcontract 70% of the howitzer's production to subcontractors in the United States. They are scheduled to conduct final integration and assembly of the XM777 at their new plant in Hattiesburg, Mississippi, beginning in the autumn of 2003 [Ref. 38]. MCOTEA did not feel that the developmental guns met the production-representative criteria required for IOT&E because BAE Systems produced them in Great Britain. Additionally, the developmental guns did not include many of the design changes resulting from developmental testing. As a result of MCOTEA's concerns, the JPO added a 2-year Low Rate Initial Production (LRIP) contract in order to procure production-representative howitzers for testing. This slipped the Full-Rate Production contract 2 years and affected other major milestones accordingly [Ref. 12: p. 3].

² VSEL merged with British Aerospace Public Limited Company (BAE) on 29 November 1999, becoming BAE Systems.

	Original February 1996 Schedule	December 1998 Schedule	December 2000 Schedule	April 2002 Schedule	Months delayed since Original 1996 Schedule
Key Milestones					
Production Contract Award: LRIP	Not Scheduled	Not Scheduled	Not Scheduled	Oct 2002	N/A
Production Contract Award: Full Rate	Dec 1999	Oct 2001	Oct 2002	Nov 2004	59
First Production Article Qualification Testing	Mar 2001	Jan 2003	Dec 2003	Apr 2004	37
Marine Corps Initial Fielding	Mar 2002	Nov 2003	Jul 2004	Mar 2005	36
Army Initial Fielding	Mar 2005	Mar 2005	Mar 2005	Aug 2006	17

Table 2. Comparison of Key Program Milestones Since the Original Schedule³

3. Cost

The LW155 Acquisition Strategy planned for cost relief through the inclusion of allies into the procurement process. Both the United Kingdom and Italy participated in the development phase of the program. Both countries provided engineers to the Joint Program Office and both initially planned to purchase and field approximately 65 systems. A trilateral Engineering and Manufacturing Development (EMD) Memorandum of Understanding (MOU) was approved in March 1999 [Ref. 18: p. 6]. A production MOU, signed by the U.K., was pending final approval by the U.S. at the conclusion of this research effort. The Italian Government had withdrawn from the MOU process by June of 2003 due to program funding issues [Ref. 32].

Most major increases in program costs correspond with previously-outlined slips in the program schedule. Re-

³ Table data is an aggregation of data from GAO Reports GAO/NSIAD-00-182, GAO-01-603R, and GAO-02-898R

negotiation of the development contract when Textron novated to VSEL as the prime contractor, required a new program baseline schedule and increased program costs. The overall increase was about \$43 million, to a total of \$1,129.9 million [Ref. 10: p. 6].

Program	July 2000	February 2001	April 2002	Total Program Cost Increase for July 2000
USMC Lightweight Howitzer RDT&E	\$ 142.6	\$ 162.8	\$ 178.5	\$ 35.9
USMC Lightweight Howitzer and TAD Upgrade Production	\$ 492.6	\$ 543.0	\$ 621.0	\$ 128.4
Army TAD Upgrade RDT&E	\$ 43.8	\$ 52.3	\$ 103.6	\$ 59.8
Army Lightweight Howitzer and TAD Upgrade Production	\$ 450.9	\$ 450.9	\$ 462.1	\$ 11.2
TOTAL	\$ 1,129.9	\$ 1,209.0	\$ 1,365.2	\$ 235.3
Costs are Then-year dollars in millions				

Table 3. Increases in Estimated Development and Production Costs of Howitzer and TAD⁴

The development contract type was restructured from a cost-plus-incentive fee contract to a cost-sharing contract in late 2000. This caused the USMC Lightweight Howitzer RDT&E funding to increase from \$142.6 million to \$162.8 million. The increases were due primarily to additional program requirements; risk reduction measures; cannon tube integration; and costs for extending the program by one year. The increase in funding of \$50.4 million in USMC Upgrade Production was due to the Marine Corps' decision to exclude those costs in previous estimates. The Army's \$8.5 million increase in TAD Upgrade RDT&E was due

⁴ Table 3 is an aggregation of data from GAO Reports GAO/NSIAD-00-182, GAO-01-603R, and GAO-02-898R

to revised equipment refurbishment requirements for testing [Ref. 11: p. 6].

Additional costing problems were created by the fluctuation in the cannon barrel cost estimates provided by Watervliet Arsenal (WVA). Previous to the 2001 GAO report, the cost of cannon barrels had fluctuated from \$106,000 to \$334,000, depending upon the workload at WVA [Ref. 11: p. 7].

In April 2002, cost estimates for the overall program increased by \$156.2 million. Increases in the USMC Lightweight Howitzer RDT&E were due primarily to the 2-year program extension associated with the LRIP contract. The USMC Howitzer and TAD Upgrade Production costs increased by \$78 million due primarily to over 1,000 design modifications made to the howitzer during development. About \$28 million were program extension costs. The Army's TAD Upgrade RDT&E costs increased by \$51.3 million primarily due to underestimation in the complexity of development and integration of software [Ref. 12: p.6].

The Government awarded BAE Systems the LRIP contract in November 2002, following a successful Milestone C decision meeting with the Assistant Secretary of the Navy (ASN) for Research, Development and Acquisition (RDA). The Fixed Price Award Fee (FPAF) contract, valued at \$138.9 million, is structured to incentivize quality and schedule. The contract also contains a Value Engineering clause to share savings between the contractor and the Government based upon cost and complexity improvements. Watervliet Arsenal will provide the cannon to the contractor as Government Furnished Material (GFM)[Ref. 17: p. 22-23].

4. Performance

Conventional fixes to problems with strength, stability and accuracy of the system were almost always in direct competition with the weight KPP [Ref. 10: p. 19]. As a result, designers focused changes around new materials and complex casting processes, as well as lengthy and comprehensive testing processes [Ref. 17: p. 11-17 and Ref. 38].

The GAO, in the course of preparing their three reports, ultimately identified seven technical problems. These were: (1) insufficient spade size, (2) flexure of the saddle assembly causing accuracy and bore-sight retention problems, (3) faulty titanium welding processes, (4) spade cracking, (5) faulty spade latch, (6) spade damper that did not operate well in all soil types, and (7) durability of the optical fire control system. MCOTEA also identified a number of technical issues that it felt would jeopardize successful completion of the IOT&E for the system. These issues were: (1) bore-sight retention, (2) accuracy, (3) durability, (4) spades, (5) design stability, (6) production-representative howitzers, (7) compressed test schedule, (8) weapon balance, and (9) logistics demonstration schedule and products. As of the July 2002 GAO Report, the program office had addressed all the identified technical problems through design changes, but all had not yet been fully field-tested. The JPO resolved the non-technical issues through additional or planned testing and addition of the 2-year LRIP phase [Ref. 12: p. 7]. The Operational Assessment (OA) conducted during the summer of 2002, fully tested and successfully addressed all

of the technical design issues raised by MCOTEA and the GAO reports. The OA was a rigorous assessment consisting of three 96-hour scenarios conducted with two weapons; two Marine Corps crews and two Army crews; and over 5,000 rounds fired [Ref. 18: p. 12]. In the opinion of the Joint Program Office, the success of the OA in proofing out the design changes was a major factor in the successful Milestone C decision in November 2002 [Ref. 38].

5. Summary

The LW155 Program will provide the Marine Corps and Army with a replacement towed cannon artillery system for the aging 155mm M198. As with most major programs, the LW155 has experienced setbacks within the areas of cost, schedule, and performance. These setbacks have caused an overall increase of almost five years to the original initiation of Full-Rate Production and of \$235.3 million in costs since 1998. However, the program successfully entered the Production and Deployment Phase of the Acquisition Life Cycle in November 2002 with a projected IOC for the Marine Corps in 2005 and the Army in 2006.

C. THE ARMY ARSENAL ACT AND THE STRATTON AMENDMENT

1. The History of Arsenals

U.S. Army manufacturing arsenals have traditionally been part of the combined public and private sector industrial base that supports the requirements of the Army forces. The first Army Arsenal, Watervliet, was established in 1813 to provide material support for the War of 1812 [Ref. 47]. However, decreases in the equipment requirements coupled with an increase in reliance upon the private sector to meet industrial needs, has significantly

reduced the Army's requirements for arsenals. At the end of World War II, the Army operated six manufacturing arsenals. Only two remain in operation today. The remaining arsenals and their primary capabilities are:

- Rock Island Arsenal (RIA)- artillery material, gun carriages, and small arms.
- Watervliet Arsenal (WVA)- seacoast gun carriages, railway mounts, artillery and tank gun tubes, mortars, and gun breeches [Ref. 9: p. 2].

The U.S. Army Material Command (AMC) established the U.S. Army TACOM (Tank-automotive Armament Command) Ground Systems Industrial Enterprise (GSIE) in October 2002 in an attempt to better manage the Army's industrial resources. These resources include non-GOCO (Government-Owned Contractor-Operated) facilities such as RIA and WVA. The long-term expectations of the GSIE program include in part: reduction in direct/indirect cost ratios; the establishment of competitive rates; the institution of "lean thinking;" [Ref. 55] and an integrated and optimally work-loaded industrial base [Ref. 46].

2. The Army Arsenal Act

The statutory language that gives shape to the present version of the Army Arsenal Act originated in 1920 as Section 5a of the National Defense Act of 1916. Section 5a was repealed by the Army Organization Act of 1950 and the language was reintroduced as Section 101(e). Section 101(e) was repealed in 1956 and replaced by the present version of the Arsenal Act codified as 10 U.S.C. Sec. 4532 [Ref. 50: p. 6]. The act is relatively succinct, consisting of the following:

Sec 4532. Factories and Arsenals: manufacture at; abolition of:

(a) The Secretary of the Army, or the Secretary of War prior to 1947, shall have supplies needed for the Department of the Army made in factories or arsenals owned by the United States, so far as those factories or arsenal can make those supplies on an economical basis.

(b) The Secretary may abolish any United States arsenal that he considers unnecessary [Ref. 27].

The statute requires the Department of the Army (DA) to justify on an economic basis, the purchase of military supplies and equipment, from howitzers to special mechanic's tools, from civilian contractors. It is important to note that the Arsenal Act does not apply to the Marine Corps, Navy, or Air Force (except when the Air Corps was part of the Army prior to 1947).

Congressman Sanford, a member of the 59th Congress, made the purpose of the act relatively clear in his March 10, 1920 remarks. He stated "the purpose of the Act is to compel the executive officers of the Government to have Government work done at such arsenals...and to cease handing out appropriations to private manufacturers [Ref. 50: p. 7]." The Comptroller General, in 1960, reaffirmed this purpose with an opinion stating that arsenals should not lay idle if they could perform needed work at a comparable cost to private industry [Ref. 50: p. 7].

The U.S. Congress enacted legislation in 1977, codified in 10 U.S.C. Sec. 2687, which effectively halted base closures by DoD and, as a result, essentially

nullified the second part of the Army Arsenal Act statute [Ref. 9: p. 58]. Under 10 U.S.C. Sec 2687, closure and realignment of any military installation in the United States now requires the Secretary of Defense to satisfy specific study and reporting requirements and to provide notification to Congress before proceeding [Ref. 26].

3. The Stratton Amendment

The U.S. Congress enacted the Stratton Amendment (10 U.S.C. Sec. 4542) in 1987. It prohibits the transfer of technical data packages (TDPs) for large-caliber cannon to foreign countries. The Amendment provides that, as a general rule, appropriated funds may not be used to:

(a) Transfer to a foreign country a technical data package for a defense item being manufactured or developed in an arsenal; or

(b) to assist a foreign country in producing such a defense item [Ref. 28].

The Secretary of the Army does have the ability to make exceptions to the provisions of Stratton Amendment. The conditions for exceptions are listed in Appendix B.

There are only two U.S. Government facilities remaining that have the capability to design large-caliber cannon tubes. The first is Benet Laboratories, located at the previously mentioned WVA. Benet Laboratories is a division of the Armament Research, Development, and Engineering Center (ARDEC) under TACOM. Its primary capabilities include the design of tank and artillery cannon [Ref. 2]. The second is the Naval Surface Warfare Center Port Hueneme Division, Louisville Detachment, located at the Naval Ordnance Station, Louisville (NOSL).

The NOSL is responsible for the technical design and support of U.S. Naval gun weapon systems [Ref. 21].

Although the Stratton Amendment applies to "large-caliber cannon", it does not define the term. However, it is a term generally accepted between the program and the engineering organizations at Picatinny Arsenal to describe cannons with an interior diameter of 40mm or greater [Ref. 39].

III. PRESENTATION OF DATA

A. INTRODUCTION

This chapter provides historical data from the LW155 Program with respect to the Arsenal Act and the Stratton Amendment. Background on the times when the program and the legislation have intersected is necessary to understand their influence on the JPO's decision-making process. The review begins with some of the pertinent laws and policies relating to Arsenal Act, as well as an examination of the recent historical guidance concerning the Arsenal Act. Next, it details arsenal capacity and workload issues. It then transitions to the three major areas of interaction between the legislation in question and the LW155 Program. These are (1) the contract solicitation and USMC/Army cooperation, (2) the handling of component design and production under the legislation, and (3) the involvement of foreign governments in the design and production process. This historical information on the points of intersection between the legislation and the LW155 Program provides the data and context necessary to analyze the JPO's actions and reactions to the legislation.

B. LAWS, POLICIES AND REGULATIONS

1. Executive Policy

The Office of Management and Budget (OMB), under authority of the President of the United States, has issued OMB Circular No. A-76 to establish Federal policy regarding the performance of commercial activities. The Circular is often by cited by civilian contractors and Government officials alike for a section stating that "In the process

of governing, the Government shall not compete with its citizens." This concept is used as the basis for prohibiting head-to-head competition between Government agencies and commercial contractors [Ref. 5: para. 4]. However, further inspection of the actual policy and scope sections of the Circular reveals in part:

...the Government shall not start or carry on any activity to provide a commercial product or service if the product or service can be procured *more economically* (emphasis added) from a commercial source...This Circular and its Supplement shall not be applicable when contrary to law...[Ref. 5: para. 5(c)-7(c)].

The OMB circular was last revised in 1999.

2. Depot Legislation

Although depots and arsenals are different, many of the functions they perform are very similar. Therefore, it is important to outline some of the legislation governing the employment of depots.

The Core Logistics Statute, codified in 10 U.S.C Sec. 2464, states in part:

It is essential for the national defense that the DoD maintain a core logistics capability that is Government-Owned and Government-Operated (GOGO) to ensure a ready and controlled source of technical competence and resources to ensure effective and timely response to a mobilization, national defense contingency situations, and other emergency requirements [Ref. 22: p. 4].

The major piece of legislation supporting the Core Logistics Statute is referred to as the "50/50 Law." 10 U.S.C. Sec 2466 requires that not more than 50% of the funds made available to a military department for depot

maintenance and repair workload may be used to contract with commercial firms to perform that maintenance [Ref. 22: p. 4]. A Report in *Government Executive Magazine* from January 2003 outlines efforts by the DoD to gain legislative relief from the 50/50 Law and bring depots under the purview of the OMB Circular A-76 guidance [Ref. 29: p. 1].

3. Army Policy Concerning the Arsenal Act

The Army has established policies and regulations regarding implementation of the Army Arsenal Act and the conduct of the required economic analysis. The basis for the manner in which costs are considered in these regulations is derived from the Comptroller General's Opinion, B-14323, issued in 1960. The opinion defined the term "economic basis" in regard to the Arsenal Act as follows:

Consequently, it is our further opinion that, in determining under this statute whether an article could have been produced in a Government-owned facility on an 'economic basis,' it would have been improper to include in the evaluation of such cost any amount which did not represent an actual expenditure by, or loss of savings to, the Government which was directly attributable to such production [Ref. 33].

As a result, the Army has further defined and delineated costing requirements that Program Management Offices must use and when they must use them.

In October 1999, the Assistant Secretary of the Army (ASA) for Acquisition, Logistics, and Technology (ALT), in collaboration with the ASA for Financial Management and Comptroller, released a Policy Memorandum titled "Army

Arsenals and Factories." The policy directed Army managers concerning procedures to account for direct and indirect cost incurred as a result of the manufacture of an item in a Government facility. The arsenal is only to be held accountable for "out-of-pocket" costs. These costs include all direct labor and material costs, but only those incremental indirect costs incurred for placing the additional work in the arsenal. The rationale is that if the arsenal is to be kept open, the fixed costs are incurred regardless of whether the arsenal is used [Ref. 33]. In their 1997 memorandum regarding the Army Arsenal Act, the Office of the DoD General Counsel opined, "this method of comparison gives the arsenals a considerable advantage over private industry [Ref. 25: p. 2]."

The Army has recently released *Army Regulation (AR) 700-90, Army Industrial Base Process*, effective 3 February 2003. It establishes the Army's policy for make or buy analysis under the Arsenal Act. Specifically, it reserves the right for the ASA (ALT) to determine which articles and supplies arsenals can and should make, and which items will be subject to the make or buy analysis. It also incorporates policy established by the Office of the Secretary of the Army (OSA) memorandum dated 30 Jul 1992 from Assistant Secretaries of the Army Conner and Livingstone. The OSA memorandum set as policy:

The Army Arsenal Statute will be implemented through make or buy decisions in preference to head-to-head competitions with private industry using formal solicitations. Army facilities will not compete on solicitations and be evaluated under the Army Arsenal Statute except...in two instances: when the economic analysis to determine if it is economical to have work

performed in-house is inconclusive; or when a solicitation involves requirements that are not appropriate for a "make" decision, but present substantial subcontracting opportunities for Army facilities...[Ref. 29: p. 7-8].

The policy basically states that arsenal availability and viability for a program should be determined by internal analysis first, then a solicitation released for private sector sourcing if no viable arsenal source is available.

C. ARSENAL CAPACITY AND WORKLOAD ISSUES

Capacity utilization and Workloads at RIA and WVA, the only two remaining manufacturing arsenals, have declined substantially since the end of the cold war. As a result, costs per unit have continued to escalate as fixed costs have been spread among decreasing amounts of workload [Ref. 9: p. 56]. During mid-1998, officials at RIA and WVA estimated the following historical utilization of manufacturing capability:

Fiscal Year	RIA	WVA
1988	81%	100%
1993	71%	46%
1998	24%	17%

Table 4. Estimated Percentage of Total
Manufacturing Capability Utilized at RIA and WVA
[Ref. 9: p. 57]

As of the 1999 GAO report, the arsenals reported using only a small portion of their available manufacturing capacity in the more than 3.3 million square feet of industrial manufacturing space. The underutilized industrial capacity has contributed to higher hourly operating rates. Over the 10 year period presented, the

hourly rates charged to customers increased by roughly 88% at WVA and 41% at RIA [Ref. 9: p. 57].

While a decline in workload does not necessary lead to higher cost, in the case of the arsenals, both RIA and WVA were left with relatively fixed overhead costs, including the salary expenses for an increasing percentage of overhead employees. For example, in 1998 WVA reported employing 473 overhead employees to only 409 direct labor employees as compared to 10 years earlier when they employed 1,089 direct labor employees to only 924 overhead employees [Ref. 9: p. 56]. The workload expressed in the number of direct labor hours reported by RIA from 1988 to 1998 are presented in Table 5:

Fiscal year	Workload (DL hours)	Workforce
1988	1,944,291	2,501
1989	Not Known	2,609
1990	1,843,268	2,442
1991	1,790,685	2,460
1992	1,2029,436	2,377
1993	1,849,193	2,289
1994	1,583,675	2,144
1995	1,557,574	2,033
1996	1,258,073	1,853
1997	1,225,849	1,730
1998	1,140,941	1,531

Table 5. Reported Arsenal Workload and
Employment Levels at RIA for Fiscal Years 1988
Through 1998 [Ref. 9: p. 57]

D. THE PROGRAM AND THE LEGISLATION

There have been three areas identified by the author, in conversation with the JPO, where the Army Arsenal Act and/or the Stratton Amendment have, or are anticipated to, intersect with the LW155 Program. These three areas are addressed below.

1. Litigation

a. The Solicitation

Two primary tenets of the acquisition strategy for the LW155 Program from its inception, were to maximize competition and leverage the development of existing competitive prototypes [Ref 15: p. 12-15]. The market research phase of the preparation of the solicitation, conducted in December 1994, resulted in the discovery of two existing prototype 155mm howitzers. Royal Ordnance, and Vickers Shipbuilding & Engineering, Ltd designed these existing prototypes. Both firms resided in the United Kingdom. Additionally, Lockheed Martin Defense Systems of Pittsfield, Massachusetts, indicated they were in the process of developing a prototype lightweight howitzer system [Ref. 19: p. 7].

The Army, in compliance with the Arsenal Act, surveyed its Arsenals to identify interest in producing a new howitzer. No indication of interest was received from any Government activity in response to the market survey [Ref. 51: p. 18]. As a result, the Government proceeded with the competitive process. However, RIA eventually showed interest in developing a prototype. They requested that the solicitation be amended to specifically allow subcontracting with DoD facilities under the provisions of

10 U.S.C. Sec 2208. The Government granted their request [Ref. 49: p. 1 and Ref. 52: p. 2].

A request for proposal (RFP) was released on 10 April 1996, soliciting offerors for a LW155. It required potential competitors to present a prototype for a shoot-off at Yuma Proving Ground, Arizona, 15 days later. Those offerors who received shoot-off contracts would remain in the competition for the Engineering and Manufacturing Development (EMD) contract. The EMD contract was to be awarded based in part upon the evaluated criteria of technical merit, past performance, and estimated immediate and long-term costs. The award was to be made to the offeror whose proposal represented the best overall value to the Government [Ref. 19: p. 8].

Lewis Machine and Tool Company of Moline, Illinois, also responded to the solicitation released in April 1996 [Ref. 19: p. 8]. RIA, because of the inclusion of the previously mentioned subcontracting clause in the RFP, became a "major subcontractor" to Lewis Machine and Tool Company [Ref. 50: pg. 4]. However, the Army shortly thereafter disqualified Lewis Machine and Tool Company from the competition because they alleged: (1) RIA's efforts were of such a substantial nature that they were in effect the prime contractor, which violated the public/private rules of the contract competition and (2) the proposal submitted by Lewis was not in compliance with the provision allowing DoD activities to compete for subcontracts because the other bidders had not been offered the opportunity to subcontract with RIA. [Ref. 52: p. 7].

The disqualification of the Lewis Machine/RIA team from the solicitation process set in motion a chain of events that resulted in two lawsuits against the U.S. Government involving the LW155 Program: Lewis Machine concerning their disqualification, and the second by the American Federation of Government Employees (AFGE), Local 2119, representing members of the RIA workforce and concerning violation of the Army Arsenal Act [Ref. 50: p. 4].

The U.S. District Court for the Eastern District of Virginia decided the first lawsuit, Lewis Machine and Tool Co. v. U.S. DoD, in favor of the DoD on 22 November 1996 [Ref. 52: p. 9]. Lewis Machine and Tool Company appealed the decision. The appeal was argued before the U.S. Court of Appeals on 10 July 1997, and once again decided in favor of the DoD on 6 October of that same year [Ref. 49: p. 2].

b. Army Production

On 27 May 1993, the USMC published a Mission Needs Statement (MNS) for the LW155 howitzer. The Army adopted the MNS on 23 September 1994. The Army announced the subsequent market survey through the Commerce Business Daily in December of that year with respondents replying with capabilities statements to ARDEC. However, it was the Department of the Navy, which in February 1995 authorized and approved funding for the transition of the process into the Concept Exploration and Definition phase of the federal acquisition process [Ref. 51: p. 18].

The Assistant Secretaries of the Army (ASA) and Navy (ASN) for Research, Development and Acquisition (RDA)

issued a joint Memorandum of Agreement (MOA) concerning the LW155 Program on 3 November 1995. The MOA outlined the terms for USMC control as the Lead Service and the Army's role as a Participating Service. It addressed funding, program leadership, and regulatory control for the joint venture [Ref. 50: p. 11].

The Acquisition Strategy Report (ASR) outlined the intent to purchase 450 howitzers for the Marine Corps and 273 howitzers for the Army [Ref. 19: p. 7]. The Marine Corps later reduced the planned procurement to 377 howitzers and the Army outlined a planned increase of 114 systems, to a total of 378 systems, to outfit the interim Brigade Combat Teams [Ref. 15: p. 14].⁵ The intent of the procurement is to outfit the Marine Corps first, beginning with LRIP in Fiscal Year (FY) 03 and transition to split production for the Army and Marine Corps in FY05 [Ref. 36].

Members of the AFGE Local 2119 employed at RIA felt that the involvement of the Army in the program, and particularly the involvement of ARDEC in the solicitation, opened the program up to applicability under the Army Arsenal Act [Ref. 51: p. 20]. As a result, they filed a lawsuit with the Central District Court of Illinois against the DoD. The suit, AFGE, Local 2119, et al. v. William S. Cohen, Secretary of Defense, et al., also involving issues with the acquisition of tank mounts for the M1 Abrams Tank, alleged violations by the Army of the Arsenal Act and numerous other statutes [Ref. 50: p. 5]. This was to be

⁵ As of July 2003, the Army's planned increase of 114 systems to outfit the interim BCTs had been postponed indefinitely [Ref. 32].

the first time in its history that the Army Arsenal Act would be tested in the courts [Ref. 34].

The AFGE lawsuit was filed on 5 March 1997. The district court dismissed the action for lack of standing. In 1999, the court of appeals affirmed in part and reversed and remanded in part the decision of the district court. They held that AFGE did have standing to sue for violations of the Arsenal Act. The majority of the case dealt with the tank mount components for the M1 Abrams Tank production and will be addressed in the following section. The case was ultimately decided in favor of the DoD in August of 2000 by the district court and affirmed by the court of appeals in August of 2001 [Ref. 50: p. 5]. Both courts found that the Arsenal Act did not apply to the LW155 howitzer program. Their rationale stated that:

Because the evidence demonstrated that the LW155 Program was a Marine Corps program to be administered under the Department of the Navy's acquisition regulations, the court determined that the Army's Arsenal Act did not apply to contracting decisions for that program [Ref. 50: p. 5]

Although the case was ultimately upheld at all levels in favor of the defendants for both the production of M1 Abrams Tank gun mount components and the LW155 Program's inapplicability under the Army's Arsenal Act, the litigation lasted from March of 1997 to August of 2001.

2. Components

Prior to the 1992 Conver-Livingstone memorandum there was relatively little change or movement in guidance published by the DoD or DA regarding the implementation of the Army Arsenal Act. However, in March of 1997, the

General Counsel of the DoD issued a memorandum to the DoD Inspector General and the Army General Counsel concerning the Arsenal Act. The memorandum addressed issues with production of the gun mount components for the upgrade to the M1A2 Main Battle Tank that were involved in the AFGE lawsuit [Ref. 25: p. 2].

The M1A2 upgrade program involved converting the M1A1 tank to the M1A2 configuration by replacing the 105-millimeter cannon with a 120-millimeter cannon and also making numerous other improvements to the tank [Ref. 25: p. 1]. The memorandum held:

In summary, the Arsenal Act does not require the Army to break down each system it acquires on a systems basis to its constituent components, determine whether an arsenal can provide such components, and then apply the Arsenal Act economic analysis to determine whether those components that an arsenal can produce in fact must be produced at an arsenal and furnished to the system prime contractor as Government-furnished material. On the other hand, if the Army has been buying a component as a separate item of supply, that component should be treated as a stand-alone supply and be subjected to an Arsenal Act economic analysis before its manufacture is shifted to the private sector [Ref. 25: p. 6].

The courts agreed on these points in their AFGE, Local 2119 et al. decisions [Ref. 51: p. 17 and Ref. 50: p. 1].

The memorandum also addressed the Crusader self-propelled artillery system. At the time, the Crusader was a research and development program. The acquisition strategy for the program was to contract with a single system contractor that would be responsible for "the manufacturing or obtaining of components of the Crusader

and assembling them into the end product weapons system." The DoD General Counsel outlined their position as follows:

...if the prime contractor is responsible for developing and producing the entire Crusader system, the Army would not be bound by the Arsenal Act to require the contractor to produce component gun mounts at an Army Arsenal [Ref. 25: p. 5].

This position, also supported by the AFGE case decisions, clearly outlined the Army's position concerning application of the Arsenal Act to contracts where a prime contractor is responsible for procuring all components, subassemblies, etc., and integrating them into a functioning end item. The Industrial Operations Command (IOC), headquartered at RIA, defines this type of contract in their Make or Buy Decision Regulation, IOC Regulation 15-4, as a "System Buy" [Ref. 43: p. 2].

In late 1999, members of Congress expressed concern because the LW155 Program "failed to fully utilize the expertise of Army arsenals in the development and design of the howitzer." As a result, the conferees directed the Army and Marine Corps to develop a plan to include RIA in the producibility and manufacturing aspects of howitzer production [Ref. 19: p. 5]. The JPO responded with a report detailing their position. First, they replied that the terms of the EMD contract (and the associated option for production of the first 190 howitzers) prevented DoD from either competing the LW155 design for production purposes, or directing its manufacture at RIA [Ref. 19: p. 11]. Next, they contended that RIA could not produce the howitzer or components at a competitive price because of

the high overhead rates caused by an 83% underutilization rate at RIA. Finally, they expressed their intent to insure RIA had every opportunity to team with the contractor and produce substantial parts of the LW155, but they would not mandate an RIA role. The contractor would be allowed to pursue a "best value" approach for selection of its subcontractors. The JPO believed the "best value" approach leveraged the advantages of competition to provide a quality product at the lowest cost [Ref. 19: p. 13-14].

3. Foreign Involvement

The Army's regulation governing the Army Industrial Base Process, AR 700-90, addresses foreign military sales (FMS). The regulation states:

Proposed FMS, co-production programs and transfers of certain technical data to foreign nations must include an Industrial Capabilities Assessment (ICA) prior to approval. *The purpose is to ensure such proposals do not undermine the industrial base goal of maintaining technological superiority over potential adversaries* (emphasis added)[Ref. 45: p. 6].

The technological superiority referred to in the regulation applies to TDPs for large-caliber cannon, as addressed in the Stratton Amendment. The Stratton Amendment, as outlined in both the previous chapter and Appendix B, prohibits the transfer of TDPs for large-caliber cannon to foreign countries except when specific exception criteria are met and approved by the Secretary of the Army [Ref. 28].

Benet Laboratories, the U.S. Government research and development laboratory located at WVA, designed the cannon assembly for the LW155 [Ref. 37]. The JPO conducted a

cost/benefit analysis in June of 2000 in response to congressional requests to consider NOSL as a producer for the cannon assembly. The JPO determined that both WVA and NOSL could produce the cannon assembly for comparatively close costs. However, NOSL had a higher technical and schedule risk than WVA [Ref. 16: p. 3, 13]. As a result, the JPO plans to provide the cannon assembly produced by WVA to the prime contractor as GFM [Ref. 36].

In mid-2002, the LW155 JPO was in the process of preparing for a Milestone C decision. WVA, the producer of the tube, had increased the per unit price of the cannon assembly over previous estimates by approximately \$100,000. The reason for the price increase was the anticipated under-funding of WVA with respect to the levels required by the Industrial Mobilization Capacity (IMC) Program [Ref. 39]. The IMC Program, formerly known as the Unutilized Plant Capacity (UPC) Program, requires the Army to maintain idle manufacturing capacity to offset possible industrial mobilization deficiencies in the private sector. Although these costs are separately programmed and budgeted, they are paid from the Defense Working Capital Fund, Army (DWCFA) if the capacity is idle more than 20% in any one month, but used at least once during the year [Ref. 45: p. 12]. Because WVA is required under the DCWFA procedures to pass costs on to their customers, the under-funding of WVA would cause an increase in overhead charges to their customers in order to cover those costs. Congress appropriates the IMC funding on an annual basis [Ref. 23: p. 1]. Army Headquarters determines the distribution of the funds among the various arsenals. WVA had expected, as had been the case in recent years, to receive only about

25% of the \$12-14 million needed to cover IMC requirements. However, Congress eventually committed increased funding [Ref. 23: p. 1] and the Army agreed to fully fund WVA's IMC needs. The IMC funding increases were not earmarked specifically for production of the LW155 cannon assemblies, but rather to compensate for the increased cost associated with maintaining required additional arsenal-wide mobilization capacity. However, the commitment to fully fund WVA's IMC Program reduced the amount of overhead costs allocated to the LW155 Program and therefore reduced the projected unit price of the cannon assembly back into the affordable range [Ref. 36].

The LW155 is currently the only lightweight towed howitzer system under development within NATO. The LW155 Program strategy was built on the basis of leveraging existing technology in allied nations. As a result, the JPO solicited international interest early in the program. The United States, the United Kingdom, and Italy signed a MOU in 1999 covering the development of the LW155 [Ref. 15: p. 15-16]. As late as May 2003, all three countries were in the final stages of staffing a production MOU [Ref. 38]. Both foreign countries indicated their plans to purchase their entire production quantities from the BAE Systems team. This strategy of teaming with allied nations helps to reduce the cost of individual howitzers through economies of scale. The number of howitzers to be purchased by Italy, the United Kingdom, and the U.S. as of the July 2002 ASR are detailed in Table 6.

Purchaser	Number of Systems	% of Total Systems
Italy	70	8%
United Kingdom	65	7%
U.S.	769	85%
<i>Marine Corps</i>	<i>377</i>	<i>42%</i>
<i>Army</i>	<i>273</i>	<i>30%</i>
<i>Army BCTs planned</i>	<i>114</i>	<i>13%</i>
Total	899	100%

Table 6. Planned Purchase from BAE Systems with Army BCTs Included as of July 2002 [Ref. 15: p. 14]

In addition to the cannon assembly, Benet Laboratories also designed the Primer Feed Mechanism (PFM) for the weapon [Ref. 37]. The production of this component has caused potential points of contention between the JPO and WVA that will be addressed in greater detail in the next chapter.

The number of systems detailed above included the anticipated additional purchase of systems by the Army for employment with the new Brigade Combat Teams (BCTs). As stated earlier, the Army eventually postponed the funding for the planned purchase of 114 additional systems. Additionally, the Italian Ministry of Defense withdrew from the production MOU negotiations due to funding problems. The revised scheduled purchases, taking into account the recent developments concerning the BCTs and the Italians, are detailed in Table 7.

Purchaser	Number of Systems	% of Total Systems
United Kingdom	65	9%
U.S.	650	91%
<i>Marine Corps</i>	377	53%
<i>Army</i>	273	38%
Total	715	100%

Table 7. Planned Purchase from BAE Systems without Italians or Army BCTs [Ref. 15: p. 14]

The decrease in the number of systems purchased by the Army and the removal of the Italians as a purchaser changes the percentage of the total systems purchased by the U.S. and the United Kingdom [Ref. 15: p. 14].

The Italian Government, since their inclusion in the program, had expressed a desire to co-produce the cannon tube for the LW155 howitzer. However, the Stratton Amendment prohibits the U.S. from providing the necessary TDPs to the Italian Government. As a result, the Italian Government had decided (before their withdrawal from the program) to absorb the expense necessary to develop and manufacture a cannon tube for the LW155 [Ref. 38].

IV. ANALYSIS

A. INTRODUCTION

The previous chapter presented the facts surrounding the events when the Army Arsenal Act and the Stratton Amendment interacted with the LW155 Program. This chapter will present an analysis of the following:

- Why this interaction occurred
- How the JPO reacted to the interaction
- What were the ramifications to the program of the interaction and the JPO's reactions

We will begin with a macro-level analysis of conditions in the post-Cold War environment that precipitated interaction between the Legislation and the LW155 Program. The analysis will then transition to the program, or micro-level. The micro-level analysis will address the finer points of the interaction with respect to the case law, components, and foreign involvement in design and production.

B. THE MACRO-LEVEL: A CHANGING ENVIRONMENT AFTER THE COLD WAR

The end of the Cold War has had a marked effect on both the public and private arenas of the defense industry in the United States. There are countless scholars and practitioners who have written in length about this matter. As an example, The Council on Foreign Relations published a collection of 15 essays by Council members that were wholly devoted to issues of the defense industrial base transformation in the post-Cold War era [Ref. 20: p. xiii]. Although the future and direction of the defense industrial

base are both important and controversial, they will not be debated here. Rather, this portion of the analysis will examine how the post-Cold War downsizing within the defense industry, with regard to protectionist legislation, such as the Army Arsenal Act and the Stratton Amendment, impacted all programs in general and the LW155 Program in particular.

1. Competing Stakeholders

The pluralistic governmental process indicative of our democratic society can lead to laws and policies that conflict in spirit, if not in language. This is often due, in the author's opinion, to the influence of the different stakeholders involved in the process of policy creation, interpretation, and enforcement. The interaction of stakeholders is particularly evident in situations where the environment encompassing an issue is changing. An excellent example of this dichotomy in legislation and policy is the recent controversy over the 50/50 Law for the work loading of military depots presented in Chapter II. The intent of the federal policy in OMB Cir. A-76 is to allow the private sector to perform those functions it can do more efficiently than the Government [Ref. 5: para. 4(a)]. Manufacturing and repair of military equipment would certainly fall under the purview of this policy. However, Congress has enacted legislation, in the form of the Core Logistics Statue and the 50/50 Law that keeps workload within depots, albeit for reasons of national security, regardless of comparable efficiency available within the private sector. The major stakeholders are as follows:

- The politicians representing the local economies supported by the depots
- The politicians representing the local economies supported by the private firms capable of performing the depot work
- The Military Services (DoD) required to fund depot work
- The depot workers (AFGE)
- The private firms

Each of these stakeholders has vested interest in seeing current laws and policies either changed or maintained.

The DoD's recent effort to repeal the 50/50 Law is indicative of the larger issue of changing priorities. The once overwhelming priority to ensure long-term capability internal to the Government has been mitigated by the immense pressure to reduce defense spending and adopt what is viewed as commercial efficiency.

If successful, the repeal would make the depots and depot workers subject to the outsourcing processes outlined in OMB Cir. A-76. However, before the draft legislation even left OMB, both the president of the AFGE and Representative Solomon Ortiz, D-Texas, the ranking member of the Readiness Subcommittee of the House Armed Services Committee and a member with a depot in his district, vowed to fight the proposal [Ref. 30: p. 1-2].

The private defense firms capable of performing the work also have a vested interest in the success of the repeal. RADM (Ret.) Don Eaton, former Deputy Commander of Logistics and Fleet Support (Navy/Marine Corps Aviation) from 1991 to 1994, attended a meeting regarding Depot work

in May of 1992, with the president of the Aerospace Industrial Association (AIA) in attendance, at their Washington, D.C. headquarters. The AIA, representing the aviation defense contractors, expressed their desire to have depot work directed to their industry. They divulged their need for a funding stream to support the aviation defense industrial base. Their need arose because the manufacturing funding streams, supported by Cold War era DoD procurements, had diminished to the point they could no longer sustain their current research, work force, and plant infrastructure levels [Ref. 14]. Therefore, one could also certainly expect the defense industry firms poised to benefit from the additional outsourcing in the current DoD repeal effort to lobby members of Congress for passage of the proposal.

Although this is an example of depot legislation rather than arsenal legislation, it presents a relevant case of how proponents of outsourcing and the forces protecting the GOGO facilities (1) have conflicting agendas and, (2) have reacted to the post-Cold War downsizing of the defense industry. In fact, the stakeholders are so similar that you could simply remove the word "depot" from the stakeholders listed earlier and replace it with the word "arsenal."

2. The Downward Spiral for Arsenals

A significant portion of a PM's perceived success or failure is his or her ability to control costs. Treating Cost As an Independent Variable (CAIV) has become an important aspect of the PM's daily life in the post-Cold War era of acquisition reform [Ref. 4: p. 4].

Unfortunately, as presented in previous chapters, the importance of arsenals as a manufacturing source has declined since the end of the Cold War. When work was plentiful for both the arsenals and the private sector during the Cold War years, the allocation of work in accordance with the Arsenal Act was not an issue. However, defense downsizing substantially reduced the amount of arsenal-type work needed. According to the GAO, the declining workload figures from 1993 to 1998, presented in Table 5, are evidence of both defense downsizing and increased reliance upon the private sector to meet the Government's needs [Ref. 9: p. 58]. As the workload decreases, the amount of the arsenal's fixed costs allocated to each unit of production increases, making the arsenals less attractive to the cost-conscious PMs.

One could attempt to blame the arsenals for their own demise for failing to respond as quickly to market forces as their private competitors. However, in many cases the arsenal managers do not determine their own fate. The Army Headquarters often controls the approval, disapproval, and funding of decisions regarding staffing levels and adjustment incentive programs such as early retirement and early resignation [Ref. 9: p. 59].

3. The Result

One major result of these changes in the utilization of arsenals since the end of the Cold War is an emphasis by the stakeholders concerned, namely the Congressional members from the affected districts and the AFGE union representing the arsenal employees, on retaining jobs. The arsenals, like the depots, have not been able to

successfully compete with the private contractors in terms of cost. As a result, the proponents of arsenals have turned to alternative strategies for maintaining workload.

C. THE BRIDGE FROM MACRO-LEVEL TO MICRO-LEVEL

In order to understand why the Arsenal Act became important to the LW155 Program, we must return all the way back to 1993-1994, when the USMC and the Army published and codified the MNS for the LW155 howitzer. The employees at RIA likely did not enter the decade of the 1990s with the expressed intent to derail the LW155 Program. Likewise, when the MNS was published by the USMC and adopted by the Army in 1993-1994, they did not scheme to deny RIA access to the program. On the contrary, it is the opinion of the author that the events that followed: the lawsuits, the congressional interest and inquiries, and the GAO investigations, were an unfortunate manifestation of both RIA's stakeholders and the JPO trying to work within their constraints, as best they could, in order to successfully operate in the post-Cold War environment.

The author has been unable to obtain information to explain why RIA had developed a prototype howitzer, but showed no interest in producing it for the Army when the market survey was announced by ARDEC in the Commerce Business Daily (CBD) in December of 1994. However, this fact is part of the court record [Ref. 51: p. 18], and this researcher could not locate any attempt by RIA or Lewis Machine and Tool Co. to argue on this point. As stated earlier in Chapter II, any interest shown by RIA would have evoked an economic analysis in accordance with the Army Arsenal Act. Furthermore, the Conver-Livingstone

Memorandum dated 30 July 1992, clearly stated that make or buy decisions were preferred to head-to-head competitions with private industry. One can assume then, barring any unusual circumstances, that a decision regarding production by RIA would have been settled very early in the LW155 acquisition process.

If an economic analysis in the form of a make or buy decision had occurred, RIA would likely have experienced a considerable advantage over private industry competitors as opined by the DoD General Counsel in their 1997 Memorandum regarding the Arsenal Act. According to current policy set by the Comptroller General in 1960, the arsenal could only be held accountable for "out-of-pocket" costs during the make or buy analysis. However, the arsenals are mission-funded and therefore are required to pass all of their anticipated costs to their customers. As a result, the LW155 program would ultimately have to pay greater costs than those utilized during the make or buy analysis to select the arsenal over the private competitors.

One possible explanation for RIA's failure to respond to the market survey is that they simply failed to read the CBD that day. However, a much more plausible explanation is a failure on their part to grasp the degree or speed of the impending decline in future business that would precipitously drop their capacity utilization from 81% in the Cold War year of 1988 to a dismal 24% within a mere ten years (see Table 4). Between the end of the Cold War and 1993, the estimated capacity utilization at RIA had dropped less than ten percent. Furthermore, there was actually a spike in the workload in FY92 and FY93 where the amount of

workload at RIA was higher than it had been in the five previous years. Figure 1 provides a graphical representation of data from Table 5 presented in the previous chapter:

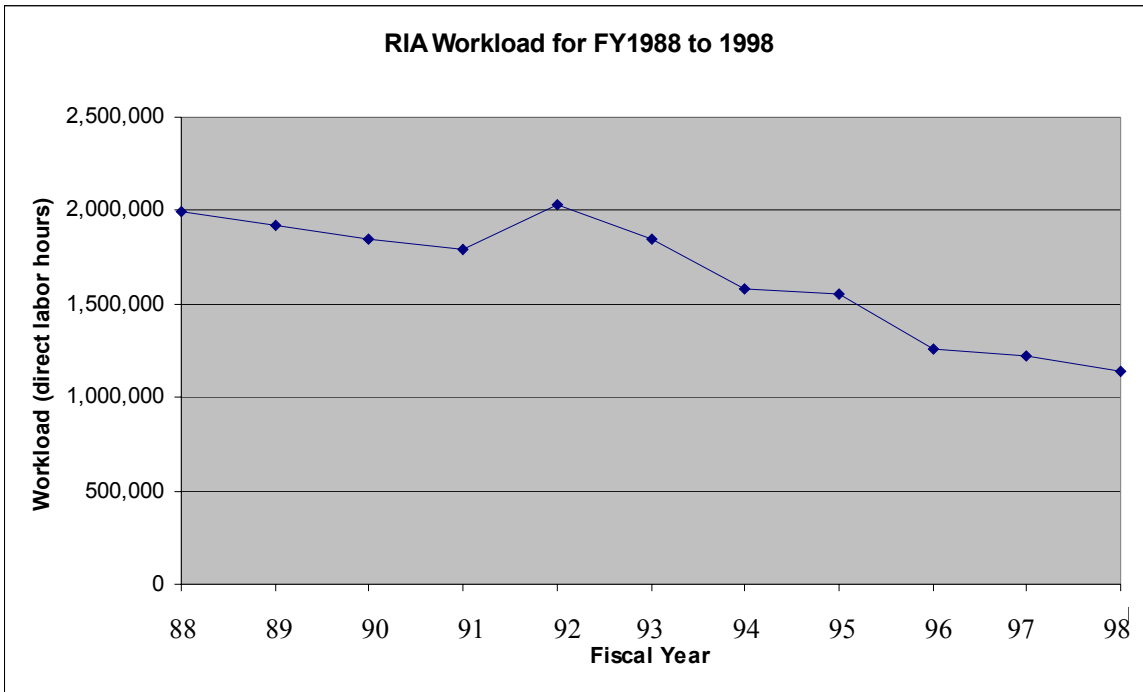


Figure 1. Reported Arsenal Workload Levels for Fiscal Years 1988 through 1998 [Ref. 9: p. 57]⁶

Additionally, RIA may have been forecasting future work, such as the M1 Abrams Tank mounts, that was subsequently cancelled. Therefore, it is completely possible that the Army's leadership and the leadership at RIA felt, as evidenced by recent workload spikes, there would be enough work in the future to allow them to safely forego involvement in the LW155 Program.

Between the market survey in early FY94 and the release of the RFP in the middle of FY96, RIA reversed

⁶ Data is derived from GAO Report GAO/NSIAD-99-31. Data for 1989 is an estimation by interpolation because direct labor hours were not available from RIA.

their position concerning their interest in the LW155 acquisition. The workload level at RIA had dropped by almost 40% from their spike just four years earlier (see Figure 1). Capacity utilization was also on the sharp decline. The capacity utilization data for RIA from Table 4 is represented graphically in Figure 2 below. While data were only available for the three points shown, the much more aggressive decline in utilization after 1993 is readily apparent.

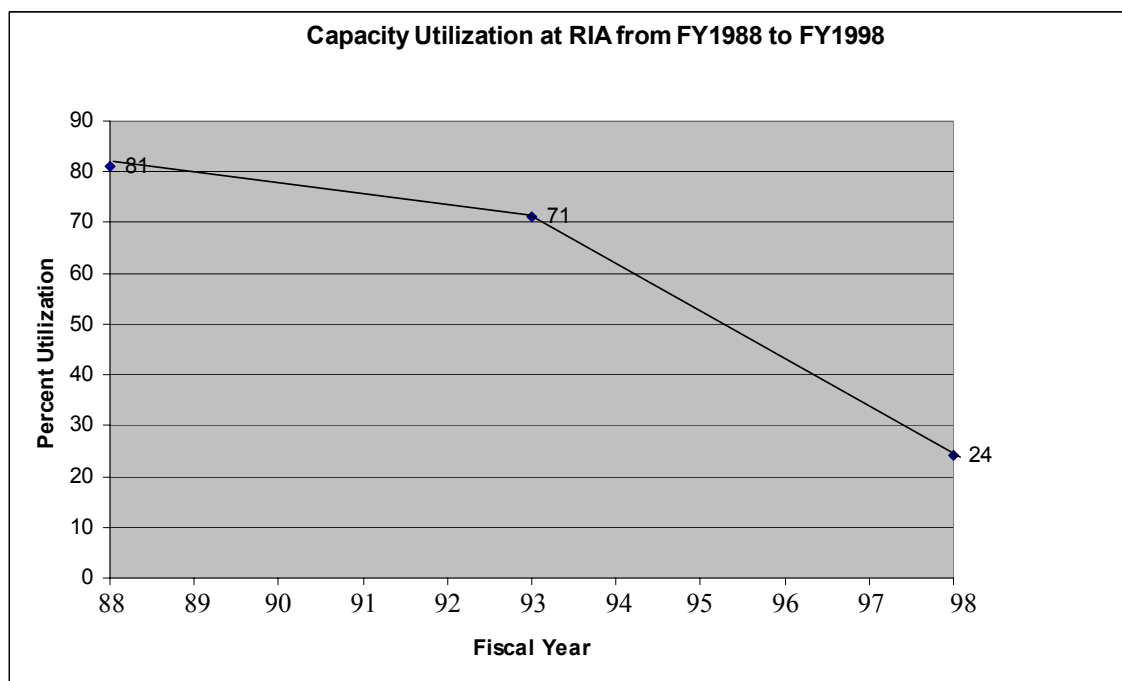


Figure 2. Capacity Utilization at RIA from FY1988 to 1998 as a Percentage of Total Manufacturing Capacity Available [Ref. 9: p. 57]

This researcher believes RIA's realization of the impending decreases in workload and capacity utilization led to their request and successful bid to have the solicitation amended to allow them to serve as subcontractor to Lewis Machine and Tool Company. More

importantly, this provides a plausible reason as to why the LW155 Program and the Arsenal Act legislation eventually intersected.

D. THE MICRO-LEVEL: THE ARSENAL ACT, THE STRATTON AMENDMENT, AND THE PROGRAM

The previous sections established a plausible explanation concerning why RIA ultimately became interested in the LW155 Program, but that is not nearly as important as the eventual result of their interest. This section will present the interaction that occurred and how it related to the legislation, how the JPO reacted, and the ramifications of their reactions.

1. Litigation

Although RIA was not a plaintiff in the Lewis Machine and Tool Co. lawsuit, they certainly had a vested interest in the outcome. In fact, Lewis' disqualification occurred because their entry was entirely RIA's prototype howitzer. This was admittedly not an Arsenal Act case. However, it is the belief of this researcher that the failure of Lewis to prevail resulted in the inclusion of the LW155 Program in the AFGE lawsuit. The AFGE lawsuit against the DoD concerned the M1 Abrams Tank mounts and was an Arsenal Act case.

a. The Interaction

The Lewis case was filed in May of 1996, shortly after they were disqualified from the EMD contract solicitation process. The U.S. District Court decided the case in favor of the Government on 22 November 1996. Less than four months later, the AFGE filed their lawsuit against the DoD claiming violation of the Arsenal Act with relation to the LW155 Program. Just four months later, the

courts began hearing Lewis' appeal. The stakeholders for RIA were, in effect, waging a two-pronged attack against the LW155 Program.

b. The Reaction

On both accounts, the JPO for the LW155 chose to defend their position rather than admit wrongdoing and submit to the plaintiffs.

c. The Results and the Ramifications

An important ramification of the decision to fight the Lewis lawsuit was the inclusion of the LW155 Program in the AFGE lawsuit. As a result, the LW155 Program was involved in almost continuous litigation from May of 1996 to August of 2001. Had the JPO found a way to award the contract to Lewis, they certainly would not have been included in the AFGE lawsuit. Although the JPO did not track the monetary costs of the litigation, it stands to reason that many salaried employees from the JPO and the supporting ARDEC legal office devoted significant time and resources to preparing for the litigation. Additionally, from a qualitative standpoint, their involvement in litigation likely lent an air of stress and uncertainty to decisions affecting the program's future. While these ramifications cannot be quantified, they certainly had at least some bearing on the quality of the JPO leadership's decisions.

Another important ramification to the LW155 Program occurred as the courts decided in favor of the Government and began transitioning into the appeals process. It is the belief of this researcher that the increased amount of Congressional interest in the program

was a result of the gradual realization that RIA would not secure the contract through a favorable Arsenal Act decision. This interest was manifested in the 1999 Congressional requirement to include RIA in producibility and manufacturing aspects of the LW155 and the Congressional request to GAO to report on and monitor the program for cost, schedule, and performance difficulties. If Congress could force the inclusion of RIA in the early production planning for the LW155 system, they would likely have a better chance of securing subcontracts related to that planning. In addition, as stated in the previous chapter, the LW155 was the only howitzer of its type planned throughout NATO. The M198 fleet of howitzers, currently used by the USMC and Army, was nearing the end of its usable life. RIA produced the M198. If the LW155 Program were cancelled because of issues publicized during the GAO Reports to Congress, RIA would likely secure substantial work associated with a remanufacture or refurbishment contract for the M198.

However, from the Army's point of view the courts, as a result of the litigation, established two important case law precedents. The first, as a result of the Lewis case, validated Army policy concerning make or buy decisions outlined in the Conver-Livingstone memorandum. The policy stipulated that make or buy decisions previous to the release of a solicitation were the rule, whereas head-to-head competition with private industry would be the exception. The second, as a result of the AFGE case, provided an important precedent both for the LW155 Program in the future and joint programs in general. As detailed in Chapter III, the USMC and Army had

fluctuated in the number of systems they intended to procure. The planned purchases varied by as much as one hundred LW155 systems per Service since the program's inception. It is even conceivable that the Army could ultimately purchase more systems than the Marine Corps. However, the courts determined that the 1995 MOA between the Navy and Army was sufficient proof of their intent early in the program for the Navy to lead the acquisition. The courts focused on the documented intent, not the evolution, of the procurement. The court decisions provided a powerful show of support for JPOs as the DoD increasingly focuses on joint requirements and programs for future military systems [Ref 3: p. A-1].

Another positive result, from the program perspective, was the successful Milestone C decision in November of 2002. The JPO suffered intense scrutiny during the GAO reviews. However, the Deputy Program Manager ultimately credits increased attention on the program's robust testing procedures and successes within the third GAO Report, published in 2001, with contributing to that successful decision [Ref. 38].

In summary, the ramifications of the litigation surrounding the LW155 Program were both negative and positive from the JPO's perspective:

Negative

- Continuous litigation was costly to the program in both quantitative and qualitative terms
- The anticipated failure of the suits led to attacks on the program through other avenues

Positive

- Established legal precedent supporting the Army's Conver-Livingstone Policy regarding implementation of the Arsenal Act
- Established legal precedent to protect MOAs between Services for Joint Programs from retroactive attacks under the purview of the Arsenal Act
- GAO attention actually contributed to a successful Milestone C decision

2. Components

The interaction between the LW155 Program and the Arsenal Act concerning howitzer components actually occurred as a result of the AFGE decisions regarding the M1 Abrams Tank upgrade program. The LW155 JPO was the fortunate recipient of the legal precedent set by the courts. The AFGE decision validated the DoD's position expressed in the 1992 General Counsel of the DoD Memorandum. The courts determined that, in a "System Buy" type contract, the individual components were not subject to make or buy analysis under the Army Arsenal Act unless the components were initially to be provided as GFM to the contractor [Ref. 50: p. 10].

a. The Interaction

The interaction between the legislation and the program occurred when Congress, in late 1999, required the JPO to "develop a plan to include RIA in producibility and manufacturing aspects of howitzer production, including recoil mechanisms and carriages for the LW155 Program [Ref. 48]." As argued in the previous section, this would certainly have given an advantage in securing future subcontracts and/or the eventual production contract, to RIA. It is important to note here that Congress never

mentioned the Arsenal Act in their Conference Report directing the RIA inclusion. This may have been due to growing pessimism over AFGE's chance for success in their pending suit.

b. The Reaction

The JPO's reaction was to respond to the Congressional directive with the *Report to the Senate and House Appropriations Subcommittees on Defense regarding a plan for Utilization of Rock Island Arsenal*. The Report outlined their intent to include RIA in development planning for production and manufacturing due to RIAs experience in these areas. It also stated that RIA would be given the opportunity to compete with industry for production and/or future work on the LW155. However, the JPO made clear their intent to allow the prime contractor to pursue a "best value" approach for selection of subcontractors without interference from the JPO. The report also pointed out that the terms and conditions within the current contract with BAE would likely make a production contract with any other source extremely costly, as well as reiterating the effect on RIA's cost-competitiveness caused by low capacity utilization [Ref. 19: p. 13-14]. All of these points by the JPO reinforced that while RIA would be given the same opportunities as any other competitor, it was highly unlikely they would have much success securing substantial contract work for the LW155.

c. The Results and the Ramifications

The U.S. District Court rendered their decision in favor of the Government in the AFGE suit on 23 August

2000 [Ref. 50: p. 5]. This was less than nine months after Congress ordered the report regarding a plan for utilization of RIA. The court's decision affirmed the Army's policies regarding components under "System Buy" contracts. In fact, the court's decision effectively established the Army's position as a legal precedent. This precedent strengthened the LW155's position regarding their treatment of components under the contract and their position regarding competition by RIA for future work. Therefore, it can be concluded that the ramification to the LW155 Program regarding treatment of components under the Arsenal Act was a positive one.

It is important to mention at this time that the AFGE court decision also established that the LW155 Program was a Department of the Navy (DoN) Program administered under DoN acquisition regulations and therefore not subject to the Army Arsenal Act [Ref. 51: p. 20-22]. However, when the JPO was making decisions and establishing their position regarding RIAs involvement, they did not yet know the outcome of the AFGE suit. Had the courts decided with the M1 Abrams Tank Program concerning components, but against the LW155 Program concerning applicability of the Arsenal Act, the JPO would still have been validated in their position concerning components.

3. Foreign Involvement

The Stratton Amendment is intended to prevent the transfer of superior technology, specifically related to large-caliber cannons, to potential adversaries. One would wholly expect the amendment to have bearing in the production of a howitzer such as the LW155. This section

will analyze two areas where the provisions of the Stratton Amendment influenced the program. These are (1) the desire by the Italians to produce their own cannon assembly, and (2) issues concerning cannon assembly pricing by WVA. Additionally, this analysis will explore issues concerning the Primer Feed Mechanism (PFM), designed at WVA, which never came to fruition, but illustrate possible problems for future programs with respect to the Stratton Amendment.

a. The Interaction

Italian Production: The first point of interaction concerning foreign involvement and the Stratton Amendment occurred with the Italians. The Italian Government, as detailed in the previous chapter, wanted to maintain the capability within their own borders to produce cannon assemblies for their LW155s. Therefore, they decided to design, engineer, develop, and manufacture their own cannon assembly.

WVA Pricing: As presented in the previous chapter, WVA was experiencing trouble securing IMC Program funding while the JPO was involved in preparation for a Milestone C decision. The resultant increase in price due to the increased overhead was approximately \$100,000 per cannon assembly. Using the number of planned systems presented in the July, 2002 ASR (see Table 6):

$$899 \text{ Total Systems} \times \$100,000 = \$89.9 \text{ million}$$

The projected total procurement cost, as of April 2002, was \$1,365.2 million (see Table 3). The \$89.9 million would equate to an increase of just over six percent to the projected total cost of the procurement.

b. The Reaction

Italian Production: The members of the JPO leadership believed they had no choice but to allow the Italian Government to produce their own cannon assemblies. They felt that even if the Italians could qualify for an exception under the Stratton Amendment, the Secretary of the Army would not look favorably upon giving up control of the technology [Ref. Shields 02may03].

WVA Pricing: The JPO had weathered three GAO audits between July of 2000 and July of 2002. The reports had detailed total program cost increases of \$235.3 million over that time period (see Table 3). The leadership of the program certainly did not want to report an additional projected increase of almost \$90 million in procurement funding at the Milestone C decision review in November 2002, less than six months after the last GAO Report. Furthermore, since the LW155 program was essentially a USMC program, the DoN and the JPO did not want to shoulder the financial burden of supporting another Service's IMC Program requirements. As a result, the Navy Acquisition Executive entered an agreement with the Army to exempt the USMC production, beginning in FY03, from IMC related costs [Ref. 39].

Additionally, the JPO had already ruled out NOSL, the only other Government facility with the capability to produce large-caliber cannon tubes, as a potential supplier. Their costs had been comparable to WVA's, but the JPO determined that their technical and schedule risk was much higher [Ref. 16: p. 3,13]. This decision, coupled with the Stratton Amendment requirement for a U.S.

producer, had forced the JPO into what was essentially a sole-source arrangement with WVA. The JPO presented their case to the Army's Acquisition leadership in order to obtain relief for WVA [Ref. 36].

c. The Results and the Ramification

Italian Production: The seventy LW155 systems planned for purchase by the Italians composed eight percent of the total purchase (see Table 6). One could make the assumption that if the Italians planned to outfit the LW155 with their own cannon assembly, they did not intend to pay for the assemblies produced by WVA. This would result in a higher cost per unit for WVA that would ultimately be passed to all purchasing Services and countries. Additionally, future cannon assembly production throughout the life cycle of the weapon system would also be reduced.

There exists another, more disturbing ramification from the decision forcing the Italians to produce their own cannon assembly. At the time the JPO was dealing with these considerations, the combined Italian and United Kingdom purchases comprised a full 15% of planned purchases (see Table 6). The British intended to buy their sixty-five LW155 systems, in their entirety, from the BAE Systems team. However, if the Italians produced a different cannon assembly, the British would then theoretically have a choice as to their supplier [Ref. 38]. This essentially shifts control from the JPO to the British Government with respect to the cannon assembly sourcing. Additionally, there was the possibility of loss of funding streams from both foreign partners with respect to the cannon assembly.

If WVA were allowed to license the TDPs to the Italians, this would result in a better situation for both parties. First, the Italian Government may have decided they did not need to actually establish the production capability for the cannon assemblies as long as they had the technology in their possession. This decision would save the Italians the significant funding outlays and potential schedule delays necessary for the development and manufacture of another cannon assembly. In addition, WVA would maintain all current planned production. Even if the Italians still chose to produce the assemblies developed by WVA, WVA could maintain a funding stream through licensing. Second, the JPO and WVA would not be susceptible to the uncertainty in production quantities caused by the United Kingdom's ability to change suppliers.

WVA Pricing: The JPO was at the mercy of the WVA's funding issues as a result of the sole-source arrangement that had evolved due to technical capabilities and Stratton Amendment requirements. As discussed in the previous chapter, the Army (with funding support from Congress) eventually agreed to fully fund WVA's IMC Program requirements.

This researcher believes that a petition for the infusion any significant additional procurement funding into the LW155 program would have been considered the least favorable option for the JPO. Scrutiny from stakeholders resulting from the RIA litigation issues addressed earlier had centered Congressional attention on the program. This forced the JPO to rely on WVA, the Army, and the

Arsenal's allies in Congress to secure a solution to the IMC Program issues.

Although the funding requirement would be the same regardless of whether the LW155 Program or WVA received it, the perception of more funding shortfalls in the LW155 Program would have had a greater negative impact on the Program. The JPO's requirement would be viewed as a \$90 million increase in procurement funds needing Congressional approval, whereas a funding increase for WVA would be viewed as an annual nine to ten million-dollar investment in the entire defense mobilization base where the LW155 program is a relatively minor player. However, WVA will have to continue to receive the required IMC Program commitment from Congress and the Army for the life of the procurement. Otherwise, the threat of cost spikes exists when the Army production of LW155 howitzers begins in FY05 and they will continue until the completion of production in FY08.

d. The Primer Feed Mechanism (PFM)

The Stratton Amendment, as previously mentioned, prohibits the transfer of TDPs for large-caliber cannon. However, the statute does not specifically detail what constitutes the "cannon." Furthermore, as of August 2003, there was no relevant case law dealing with application of the Stratton Amendment [Ref. 34]. This is significant because a law that has not been tested is much less bounded and defined than one, such as the Arsenal Act, that has seen scrutiny by the courts. As a result, a program office has more freedom of interpretation when establishing their position with respect to the law.

Benet Laboratory at WVA developed the PFM. The PFM is a magazine device designed to feed explosive primers into the breechblock at the rear of the cannon tube. The program office contends that the PFM is new technology that is not part of the "cannon." Benet Laboratories contends that because the PFM was developed at WVA, it is subject to the Stratton Amendment. The JPO does not agree with their contention concerning the cause/effect relationship. In other words, they do believe that just because something is developed at WVA, the Stratton Amendment automatically covers it [Ref. 37].

There is no longer an active issue concerning the PFM. WVA was able to price the PFM within five percent of commercial quotes. The program office felt this, coupled with the reduced risk associated with integrating the PFM with the breech during manufacture, justified purchase from WVA. However, the JPO contends that a substantial price difference with commercial quotes would have led them to search globally for a supplier [Ref. 31]. This would likely have result in a challenge by WVA or its stakeholders for violation of the Stratton Amendment that would result in the eventual creation of the first case law precedent for the Stratton Amendment.

e. BAE Systems' Answer to the Stratton Amendment

In 2003, BAE Systems informed the JPO of their intent to establish a U.S. subsidiary to contract for full-rate production [Ref. 31]. As a result, the subsidiary will be considered a U.S. firm, not a foreign one. While their reasoning was not made available at the time this MBA Project was published, BAE Systems likely explored many

benefits to creating a U.S. subsidiary. Relief from the export limitations of the Stratton Amendment for future procurements may very well have been a factor in their decision.

THIS PAGE INTENTIONALLY LEFT BLANK

V. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

The post-Cold War era of decreasing defense budget and increased emphasis on joint capabilities among the Services make it imperative that PMs stay attuned to the requirements, limitations, and restrictions caused by protectionist legislation such as the Army Arsenal Act and the Stratton Amendment.

1. Primary Research Question Review

- What is the impact of the Army Arsenal Act (10 U.S.C. 4532) of 1920 and the Stratton Amendment (10 U.S.C. 4542) of 1986 upon the development and procurement of Department of Defense (DoD) Weapon Systems such as the LW155?

The end of the Cold War ushered in changing priorities from the senior leadership of DoD. Focus on cost savings and efficiency has increased as the DoD's portion of the Federal budget has decreased. Private industry, able to adapt faster to changes in the environment, coupled with a policy focused on contracting out manufacturing work to the private sector, has dramatically reduced the work available to manufacturing arsenals. The decrease in available work at the arsenals has caused higher overhead rates. The higher rates result in less work from the cost-conscious Program Managers within DoD. As a consequence, a vicious downward spiral in capacity utilization and workload has led to arsenals that are not cost-competitive with industry. The arsenals and their stakeholders are then left to find other means to gather and maintain manufacturing work.

One means the arsenals have attempted in order to secure work and thus prolong their future is the implementation of protectionist laws such as the Army Arsenal Act and the Stratton Amendment. The Army Arsenal Act, established in 1920, requires the Army to make their supplies in the arsenals if they can do so more economically than a commercial source. The Stratton Amendment, established in 1986, prohibits the transfer of large-caliber cannon tube technology to foreign countries. There was less emphasis on these laws during in the Cold War era when defense work was plentiful. However, they are now proving to be important protectionist tools in the fight to keep Arsenal personnel employed and facilities utilized at the Army's only two remaining manufacturing arsenals: Rock Island and Watervliet.

The Army Arsenal Act primary affects large ground-based weapon systems. In a program such as the LW155, where the program office is attempting to leverage existing research and development efforts, the Army Arsenal Act can become a factor for two major reasons. First, the Comptroller General's 1960 determination to use only "out-of-pocket" expenses during the make or buy analysis required under the Act places private industry competitors at a disadvantage in initial source selection determinations. More importantly, the PMO's outlays to the arsenal are not the same as those used for the make or buy decision. Second, failure by the program office, in an Army-specific, or Joint Service venture involving the Army, to explore the applicability of the Army Arsenal Act can lead to prolonged interest and involvement by those with a stake in the survival of our national arsenals. It is the

job of the Judicial Branch of Government to interpret the law. As a result, differences of opinion between the program office and the arsenal stakeholders will likely culminate in lengthy court battles that will ultimately slow the progress of the program, redirect resources, and hinder the PM's ability to make decisions in the best interest of the system's end-user.

The Stratton Amendment impacts any weapon system program that incorporates a large-caliber cannon into the design. The PMO is prevented from transferring the TDPs for cannon technology to foreign countries without special waiver from the Secretary of the Army. This can negatively impact the PM's ability to reduce program costs and increase multi-national cooperation by limiting the allowable involvement of allies in design, development, and production.

In summary, the Army Arsenal Act and the Stratton Amendment are legislative statutes designed to protect the viability of our national arsenals. The statutes ultimately serve to constrain the PM's ability to freely pursue "best value" and cost saving measures for the program. Therefore, from the perspective of the PM, they can limit his/her ability to make the decisions necessary to provide the best overall product to the end-user.

2. Subsidiary Questions Review

- What is the XM777 Joint Lightweight Howitzer Program?

The XM777 Joint Lightweight Howitzer, or LW155, is a Joint Marine Corps and Army towed artillery system designed to provide both close and deep fires to support both Marine

Corps and Army Maneuver forces. The XM777 is scheduled to replace the aging M198 weapon system currently in the Army and Marine Corps inventories. The goal of the LW155 program is to produce and field a weapon system that is considerably lighter in weight and easier to support logistically than the current system.

The Marine Corps approved the MNS in 1993 and the Army adopted it the following year. The JORD was approved by both Services in 1995, and the RFP for the EMD contract was released on April 10, 1996. The intent of the program was to leverage the development of existing competitive prototypes. The team of Textron Marine and Land Systems of New Orleans and VSEL of England was awarded the contract following a shoot-off competition. However, a series of contract novations and industry mergers left the EMD contract in the hands of BAE Systems, a United Kingdom company, in November of 1999. The JPO achieved a successful Milestone C decision in November of 2002 and BAE Systems was subsequently awarded the LRIP contract.

The LW155 program, like most other major defense programs, has experienced cost growth, schedule delays, and performance setbacks. Problems with the original contractor added almost three years to the program and testing issues concerning availability of production-representative howitzers added two more. Most major cost growth problems related to the major slips in the schedule. Additional cost uncertainties were a result of fluctuations in cannon barrel costing from WVA. The GAO in their reports, and the MCOTEA in their testing, identified several technical design problems and non-technical issues

involving the LW155 program. The JPO resolved the technical issues through additional testing and inclusion of an LRIP phase. The technical design problems were successfully proved-out during the OA held in mid-2002. Although the program has experienced almost five years of delays and \$235.3 million of cost growth since 1998, it successfully entered the Production and Deployment Phase in November 2002 with a projected IOC for the Marine Corps in 2005 and the Army in 2006.

- What are the Army Arsenal Act and the Stratton Amendments?

Congress, in 1920, enacted the original legislation that would eventually be codified as the Army Arsenal Act in 10 U.S.C. Sec 4532. The Arsenal Act requires the Secretary of the Army to have supplies needed for the Army manufactured in arsenals so far as the arsenals can make those supplies on an economic basis. The purpose of the statute, well recognized by both the Executive and Judicial Branches, is aimed at preserving the Government's in-house production capabilities. RIA and WVA are the only two remaining U.S. Government-owned and operated manufacturing arsenals.

The Stratton Amendment of 1987, as codified U.S.C. Sec. 4542, is another statute designed to protect arsenal production capabilities. The Amendment prohibits the transfer of TDPs for large-caliber cannon to a foreign country for a defense item being manufactured or developed in an arsenal. The Amendment does allow for exception under specific circumstances and with approval of the Secretary of the Army. WVA is the primary benefactor of the Stratton Amendment because it is the only GOGO facility

remaining with the capability and expertise necessary to design or produce large-caliber cannon.

Although the statute clearly defines the requirements for exception under the law, it is ambiguous concerning what constitutes a TDP for a large-caliber cannon. The Stratton Amendment, unlike the Army Arsenal Act, is as yet untested in the courts.

- On what occasions have the Army Arsenal Act and the Stratton Amendments affected the LW155 Program and why, how did the JPO react, and what were the ramifications to the program of their reactions?

There have been three occasions since the approval of the MNS in 1993 when the LW155 program and the legislation in question have interacted. These occasions coincide with (1) the litigation; (2) production of components; and (3) foreign involvement in the program. Each of these occasions, as well as the JPOs reaction, and the results and ramifications on the program are summarized in Table 8.

The first occasion for interaction occurred when RIA was disqualified from the shoot-off competition for the LW155 EMD contract. Their disqualification led Lewis Machine and Tool Co., the contractor representing RIA's prototype howitzer, to unsuccessfully file suit against the Government in an attempt to gain the contract. Shortly thereafter, the AFGE chapter representing RIA's employees brought suit against the Program as well. They attempted, again unsuccessfully, to show the LW155 Program had significant Army involvement and therefore should have conducted a make or buy analysis prior to release of the EMD solicitation in accordance with the requirements of the

Army Arsenal Act. Although unsuccessful, these suits continually involved the JPO in litigation from 1996 to 2001. The attention brought by the suits led to a spectacular amount of Congressional interest in the program including three intensive GAO reviews and a Congressional mandate for utilization of RIA. The suits did eventually result in three decisions beneficial to the LW155 and ultimately all Army programs: (1) The Lewis case validated the Army's policy for make or buy decisions set forth in the Conver-Livingstone Memorandum of 1992; (2) The AFGE case validated the Services' rationale for determining the Lead Service in a joint program; and (3) The M1 Abrams Tank cannon mount portion of the AFGE case validated the Army policy concerning a prime contractor's right to choose subcontractors when purchasing components under "System Buy" type contracts without fear of violating the Army Arsenal Act.

The second occasion for interaction, production of components, became an issue when in late 1999 Congress, probably predicting the failure of the AFGE suit to force applicability under the Arsenal Act, issued their requirement to include RIA in plans for producibility and manufacturing. The JPO responded with a report detailing their plan to leverage RIA's knowledge and experience. However, it also presented their intent to allow the contractor, under the "System Buy" policy, to make "best value" decisions concerning components. The appellate decision in the AFTE case reinforced the JPO's position concerning the contractor's responsibilities under the "System Buy" type of contract.

The third occasion for interaction, foreign involvement, became an issue first when the Italian Government made the decision to produce cannon assemblies, and later when WVA raised the price of the cannon tubes by approximately \$100,000. The Stratton Amendment prevented the JPO from supplying the cannon assembly TDPs to the Italians. As a result, the Italians decided to absorb the significant additional cost of developing and producing their own version of the cannon assemblies. WVA stood to lose up to nine percent of their total production with the possibility of losing up to 15% if the U.K. decided to purchase cannon assemblies from Italy instead of the U.S. The JPO would also see a per-unit cost increase for the cannon assemblies as the overhead costs at WVA were spread over fewer production units.

Prior to the November 2002 production decision, WVA notified the JPO that the price of each cannon assembly would increase by approximately \$100,000 due to under-funding of IMC Program requirements at WVA. The LW155 program would have had to absorb their share of the overhead costs, amounting to almost \$90 million over the life of the program, associated with the funding cuts. The DoN reached an agreement with the Army to exempt the USMC production items from IMC costs. Additionally, they agreed to fully fund WVA's base operations for the first year. However, the arsenals and the JPO will still remain susceptible to the effects of future funding cuts to the arsenals when Army production begins in FY05. More importantly, the entire pricing structure of the Arsenals is at the mercy of annual IMC funding decisions beyond their control. This fact alone makes GOGO arsenals less

attractive to PMs. The risk associated with cost fluctuations caused by funding decisions outside the control of the arsenal makes private contractors, with more control over corporate funding decisions, a significantly less risky alternative.

Occasion	JPO Reaction	Results/Ramifications
<i>Army Arsenal Act (AAA)</i>		
Litigation: RIA disqualified from EMD competition (1996)	Defend their position	LMTC (appellate decision in 1997) and AFGE (appellate decision in 2000) lawsuits
		Four years of continuous litigation and uncertainty about program's future
		Congressional interest and oversight
		-Three GAO reports
		-Congressional report
		Case law precedents
		-Make or buy decision timing
		-AAA in joint programs
		-System Buy vs. component break-out
Components: Congress requires report on plan to utilize RIA (1999)	Report outlines JPO's "best value" approach	No further requirements surfaced from Congress concerning utilization of RIA and the AFGE System Buy decision supported Army Policy and JPO's position
<i>Stratton Amendment (SA)</i>		
Foreign Involvement: Italians decide to manufacture Cannon Assembly	Concedes and does not pursue exception to SA	U.K. now has choice of Cannon Assembly suppliers
		Monetary loss to program/WVA
		-Per unit cost increase
		-WVA loss of up to 15% of Cannon Assembly production
WVA raises price of Cannon Assembly prior to Milestone C decision	Alerts stakeholders to effect on program	Funding commitment secured from Army & Congress, but WVA ICM Program funding still susceptible to cuts in future years of program

Table 8. Summary of Arsenal Act and Stratton Amendment Interaction with LW155 Program.

Another issue involving the Stratton Amendment and PFM production never came to fruition, but the JPO's stance on the issue is none-the-less important. The JPO contends that not everything designed at WVA automatically falls under the Stratton Amendment for that reason alone. The LW155 team ultimately decided to let WVA manufacture the PFM for reasons of cost and risk. However, the JPO asserts that under different circumstances they would defend their position in the courts if necessary. This is an excellent example of how the position of a stakeholder influences the interpretation of the law.

BAE Systems also informed the JPO in 2003 of their intention to create a U.S. subsidiary for the full-rate production contract administration. As a result, the U.K.-based contractor would be able to avoid all manner of issues involving the Stratton Amendment and other legislation dealing with the export of data.

B. RECOMMENDATIONS

The resurgence of emphasis on the Army Arsenal Act and the Stratton Amendment as tools for protecting the future viability of manufacturing arsenals serves as a signal to PM community. This researcher believes it is in the best interest of both the program office and their programs that they perform the following:

- Consult with the program or potential program's legal representation as early as possible in the acquisition process concerning applicability of the Army Arsenal Act. Particularly in joint service programs, this research has shown that applicability of the Arsenal Act is not necessarily dependent upon which Service is dedicating the majority of the funding because programs change over time. Rather, clearly

establishing the program documentation and role of each Service is paramount to defending the position of the program with regard to the Act.

- Review the Stratton Amendment for any program containing a weapon system with even the potential of incorporating a large-caliber cannon.
- Incorporate applicability of protectionist legislation into early risk assessment processes for any program where make/buy decisions, or teaming with foreign nations are possible acquisition strategies.

C. POTENTIAL AREAS FOR FURTHER RESEARCH

The following areas for potential further study are based upon the conclusions of this research effort:

- Research in depth the advantages and disadvantages of the Army's current requirements and procedures for conducting an economic analysis in accordance with the Army Arsenal Act.
- Explore in depth the potential conflicts between legislation designed to protect GOCO facilities, (both arsenals and depots), protectionist legislation designed to protect both public and private U.S. industries from foreign competition, and the DoD's current policies concerning outsourcing and teaming with global allies.
- Conduct a case study regarding the Army Arsenal Act and the Stratton Amendment similar to the one conducted here, but from the perspective of the Arsenals and their stakeholders.

APPENDIX A. GLOSSARY OF ACRONYMS

AFGE	American Federation of Government Employees
AIA	Aerospace Industrial Association
ALT	Acquisition, Logistics, and Technology
AMC	Army Material Command
AMC-R	Army Material Command Regulation
AR	Army Regulation
ARDEC	Armament Research, Development, and Engineering Center
ASA	Assistant Secretary of the Army
ASN	Assistant Secretary of the Navy
ASR	Acquisition Strategy Report
BAE	British Aerospace Systems
BCT	Brigade Combat Team
CA	Cannon Assembly
CBD	Commerce Business Daily
DA	Department of the Army
DL	Direct Labor
DoD	Department of Defense
DoN	Department of the Navy
DWCFA	Defense Working Capital Fund, Army
EMD	Engineering and Manufacturing Development
FPAF	Fixed Price Award Fee

FY	Fiscal Year
GAO	General Accounting Office
GFM	Government Furnished Material
GOCO	Government-Owned Contractor-Operated
GOGO	Government-Owned Government-Operated
GPS	Global Positioning System
GSIE	Ground Systems Industrial Enterprise
ICA	Industrial Capabilities Assessment
IMC	Industrial Mobilization Capactiy
IOC	Initial Operational Capability
IOT&E	Initial Operational Test and Evaluation
JORD	Joint Operational Requirements Document
JPO	Joint Program Office
KPP	Key Performance Parameters
LMTC	Lewis Machine and Tool Company
LRIP	Low-Rate Initial Production
LW155	XM777 Joint Lightweight Howitzer System
MCOTEA	Marine Corps Operational Test and Evaluation

Agency

MNS	Mission Needs Statement
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
NATO	North Atlantic Treaty Organization
NOSL	Laval Ordnance Station Louisville

OA	Operational Assessment
OMB	Office of Management and Budget
OSA	Office of the Secretary of the Army
OT&E	Operational Test and Evaluation
PFM	Primer Feed Mechanism
PM	Program Manager
PMO	Program Management Office
RDA	Research, Development and Acquisition
RDT&E	Research, Development, Test and Evaluation
RFP	Request For Proposal
RIA	Rock Island Arsenal
SCP	Schedule, Cost and Performance
TACOM	Tank-automotive Armament Command
TAD	Towed Artillery Digitization
TDP	Technical Data Package
U.K.	United Kingdom
UPC	Unutilized Plant Capacity
U.S.C.	United States Code
USMC	United States Marine Corps
VSEL	Vickers Shipbuilding and Engineering Ltd.
WVA	Watervliet Arsenal
XM777	Experimental M777 Joint Lightweight Howitzer

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX B. THE STRATTON AMENDMENT

10 USC Sec. 4542

TITLE 10 - ARMED FORCES
Subtitle B - Army
PART IV - SERVICE, SUPPLY, AND PROCUREMENT
CHAPTER 433 - PROCUREMENT

-HEAD-

Sec. 4542. Technical data packages for large-caliber cannon: prohibition on transfers to foreign countries; exception

-STATUTE-

(a) General Rule. - Funds appropriated to the Department of Defense may not be used -

(1) to transfer to a foreign country a technical data package for a defense item being manufactured or developed in an arsenal;

or

(2) to assist a foreign country in producing such a defense item.

(b) Exception. - The Secretary of the Army may use funds appropriated to the Department of Defense to transfer a technical data package, or to provide assistance, described in subsection (a) if -

(1) the transfer or provision of assistance is to a friendly foreign country (as determined by the Secretary of Defense in consultation with the Secretary of State);

(2) the Secretary of the Army determines that such action -

(A) would have a clear benefit to the preservation of the production base for the production of cannon at the arsenal concerned; and

(B) would not transfer technology (including production techniques) considered unique to the arsenal concerned, except as provided in subsection (e); and

(3) the Secretary of Defense enters into an agreement with the country concerned described in subsection (c) or (d).

(c) Co-production Agreements. - An agreement under this subsection shall be in the form of a Government-to-Government Memorandum of Understanding and shall include provisions that -

(1) prescribe the content of the technical data package or assistance to be transferred to the foreign country participating in the agreement;

(2) require that production by the participating foreign country of the defense item to which the technical data package or assistance relates be shared with the arsenal concerned;

(3) subject to such exceptions as may be approved under subsection (f), prohibit transfer by the participating foreign country to a third party or country of -

(A) any defense article, technical data package, technology, or assistance provided by the United States under the agreement; and

(B) any defense article produced by the participating foreign country under the agreement; and

(4) require the Secretary of Defense to monitor compliance with the agreement and the participating foreign country to report periodically to the Secretary of Defense concerning the agreement.

(d) Cooperative Project Agreements. - An agreement under this subsection is a cooperative project agreement under section 27 of the Arms Export Control Act (22 U.S.C. 2767) which includes provisions that -

(1) for development phases describe the technical data to be transferred and for the production phase prescribe the content of the technical data package or assistance to be transferred to the foreign country participating in the agreement;

(2) require that at least the United States production of the defense item to which the technical data package or assistance relates be carried out by the arsenal concerned; and

(3) require the Secretary of Defense to monitor compliance with the agreement.

(e) Licensing Fees and Royalties. - The limitation in subsection (b)(2)(B) shall not apply if the technology (or production technique) transferred is subject to nonexclusive license and payment of any negotiated licensing fee or royalty that reflects the cost of development, implementation, and prove-out of the technology or production technique. Any negotiated license fee or royalty shall be placed in the operating fund of the arsenal concerned for the purpose of capital investment and technology development at that arsenal.

(f) Transfers to Third Parties. - A transfer described in subsection (c)(3) may be made if -

(1) the defense article, technical data package, or technology to be transferred is a product of a cooperative research and development program or a cooperative project in which the United States and the participating foreign country were partners; or

(2) the President -

(A) complies with all requirements of section 3(d) of the Arms Export Control Act (22 U.S.C. 2753(d)) with respect to such transfer; and

(B) certifies to Congress, before the transfer, that the transfer would provide a clear benefit to the production base of the United States for large-caliber cannon.

(g) Notice and Reports to Congress. - (1) The Secretary of the Army shall submit to Congress a notice of each agreement entered into under this section.

(2) The Secretary shall submit to Congress a semi-annual report on the operation of this section and of agreements entered into under this section.

(h) Arsenal Defined. - In this section, the term 'arsenal' means a Government-owned, Government-operated defense plant that manufactures large-caliber cannon.

-SOURCE-

(Added Pub. L. 99-500, Sec. 101(c) (title IX, Sec. 9036(b)(1)), Oct. 18, 1986, 100 Stat. 1783-82, 1783-107, and Pub. L. 99-591, Sec. 101(c) (title IX, Sec. 9036(b)(1)), Oct. 30, 1986, 100 Stat. 3341-82, 3341-107; Pub. L. 99-661, div. A, title XII, Sec. 1203(a)(1), Nov. 14, 1986, 100 Stat. 3968; amended Pub. L. 101-189, div. A, title VIII, Sec. 806, Nov. 29, 1989, 103 Stat. 1489; Pub. L. 102-190, div. A, title X, Sec. 1061(a)(24), 1086, Dec. 5, 1991, 105 Stat. 1473, 1483.)

-CODIFICATION-

Pub. L. 99-591 is a corrected version of Pub. L. 99-500.

Pub. L. 99-500, Pub. L. 99-591, and Pub. L. 99-661 added identical sections.

-MISC3-

AMENDMENTS

1991 - Subsec. (b)(1). Pub. L. 102-190, Sec. 1086(a), substituted 'friendly foreign country' for 'member nation of the North Atlantic Treaty Organization or a country designated as a major non-NATO ally'.

Subsec. (c)(3). Pub. L. 102-190, Sec. 1061(a)(24)(A), 1086(b)(1), amended par. (3) identically, substituting 'subsection (f)' for 'subsection (d)' in introductory provisions.

Subsec. (f). Pub. L. 102-190, Sec. 1061(a)(24)(B), 1086(b)(2), amended subsec. identically, substituting 'subsection (c)(3)' for 'subsection (b)(3)' in introductory provisions.

1989 - Subsec. (b)(1). Pub. L. 101-189, Sec. 806(a)(1), substituted 'a member nation of the North

Atlantic Treaty Organization or a country designated as a major non-NATO ally'' for ''a friendly foreign country''.

Subsec. (b)(2)(B). Pub. L. 101-189, Sec. 806(a)(2), inserted '', except as provided in subsection (e)'' after ''arsenal concerned''.

Subsec. (b)(3). Pub. L. 101-189, Sec. 806(a)(3), inserted ''or

(d)'' after ''subsection (c)''.

Subsecs. (d), (e). Pub. L. 101-189, Sec. 806(b)(2), added subsecs. (d) and (e). Former subsecs. (d) and (e) redesignated (f) and (g), respectively.

Subsec. (f). Pub. L. 101-189, Sec. 806(b)(1), redesignated subsec. (d) as (f). Former subsec. (f) redesignated (h).

Subsec. (f)(1). Pub. L. 101-189, Sec. 806(c), inserted ''or a cooperative project'' after ''cooperative research and development program''.

Subsecs. (g), (h). Pub. L. 101-189, Sec. 806(b)(1), redesignated subsecs. (e) and (f) as (g) and (h), respectively.

EFFECTIVE DATE

Section 101(c) (title IX, Sec. 9036(c)) of Pub. L. 99-500 and Pub. L. 99-591, and section 1203(b) of Pub. L. 99-661 provided that: ''Section 4542 of title 10, United States Code, as added by subsection (a), shall apply with respect to funds appropriated for fiscal years after fiscal year 1986.''

RULE OF CONSTRUCTION FOR DUPLICATE AUTHORIZATION AND APPROPRIATION PROVISIONS OF PUBLIC LAWS 99-500, 99-591, AND 99-661 For rule of construction for certain duplicate provisions of Public Laws 99-500, 99-591, and 99-661, see Pub. L. 100-26, Sec. 6, Apr. 21, 1987, 101 Stat. 274, set out as a note under section 2302 of this title.

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF REFERENCES

1. BAE Systems letter, Ref: XM777 Supply Chain RFQ ARM0445, to U.S. Army Rock Island Arsenal, 13 Jan 2003.
2. Benet Laboratories. "About Benet."
<http://www.benet.wva.army.mil/transfer.html>, 2 May 2003.
3. Chairman of the Joint Chiefs of Staff Instruction, "Joint Capabilities Integration and Development System (JCIDS)," CJCSI 3170.01C, 24 Jun 2003.
4. Department of Defense, Directive 5000.1, 12 May 2003.
5. Executive Office of the President, Office of Management and Budget, *OMB Circular A-76*, [Online] Available
<http://www.whitehouse.gov/omb/circulars/a076/a076.html>,
Revised 1999.
6. Federal Acquisition Regulation (FAR), FAC 2001-01. 21 Dec 2001.
7. Federation of American Scientists, Military Analyst Network, "XM777 Lightweight 155mm Howitzer (LW155)," [Online] Available <http://www.fas.org/man/dod-101/sys/land/lw155.htm>, 15 Dec 1998.
8. Ford, William M., *DoD Depot-Level Maintenance: Factors to Consider in Public/Private Competition*. Master's Thesis. Naval Postgraduate School. Monterey, California. Dec 1998
9. General Accounting Office, GAO/NSIAD-99-31, "Army Industrial Facilities: Workforce Requirements and Related Issues Affecting Depots and Arsenal," Nov 1998.
10. General Accounting Office, GAO/NSIAD-00-182, "Defense Acquisitions: Howitzer Program Experiencing Cost Increases and Schedule Delays," Jul 2000.
11. General Accounting Office, GAO-01-603R, "Status Update of the New 155mm Lightweight Howitzer," Apr 2001.

12. General Accounting Office, GAO-02-898R, "2002 Update Of the 155mm Lightweight Howitzer," Jul 2002.
13. Howze, Marc A. "The Arsenal Act: To What Facilities Does it Apply?" U.S. Army Material Command, Office of Command Counsel Newsletter, Volume 99-5, p. 4. [Online] Available http://www.amc.army.mil/amc/command_counsel/resources/documents/newsletter99-5/nlre9905.pdf. Oct 1999.
14. Interview between Donald Eaton, RADM (Ret.), Logistics Chair, Naval Postgraduate School, Graduate School of Business and Public Policy, Naval Postgraduate School, Monterey, California, and the author 6 Aug 2003.
15. Joint Program Management Office, XM777 Joint Lightweight Howitzer, *Acquisition Plan, Acquisition Strategy Report for Lightweight 155mm Towed Howitzer*, Picatinny Arsenal, New Jersey. 5 Jul 2002.
16. Joint Program Management Office, XM777 Joint Lightweight Howitzer, *Assistant Secretary of the Navy, Cannon Brief*, Picatinny Arsenal, New Jersey. 13 Jul 2000.
17. Joint Program Management Office, XM777 Joint Lightweight Howitzer, "LW155 Milestone C Decision Briefing to The Honorable John J. Young, Jr. Assistant Secretary of the Navy (Research, Development, and Acquisition)," Briefing, 8 Nov 2002.
18. Joint Program Management Office, XM777 Joint Lightweight Howitzer, "LW155 Overview to Admiral Sabrowski," Briefing, 8 Oct 2002.
19. Joint Program Management Office, XM777 Joint Lightweight Howitzer, "Report to the Senate and House Appropriations Subcommittees on Defense: Regarding a Plan for the Utilization of Rock Island Arsenal," Dec 1999.
20. Markusen, Ann R. and Sean S. Costigan, Editors. *Arming the Future: A Defense Industry for the 21st Century*, Council of Foreign Relations Press, 1999.
21. NAVSEA Port Hueneme, Surface Warfare Center Division, Louisville Detachment, "Gun Weapon System Station." <http://www.phdnswc.navy.mil/detachments/lv/>, 2 May 2003.

22. Office of the Assistant Secretary of the Army, Acquisition, Logistics, and Technology, "Policy Memorandum, Subject: Depot Considerations in Army Acquisition and Interim Policy Consideration of Product Support Strategies," 9 Jan 2003.
23. Office of Congressman Lane Evans, Press Release, "Evans Announces House Approves Defense Bill with Millions for Programs Benefiting R.I. Arsenal," [Online] Available http://www.house.gov/evans/news/archive_2002/defense_arsenal.htm, 20 Dec 2001.
24. Office of the Deputy for Systems Management, Office of the Assistant Secretary of the Army (Acquisition, Logistics and Technology, *U.S. Army 2002 Weapons Systems Handbook*. 2002.
25. Office of the General Counsel, Department of Defense, "Memorandum for DoD Inspector General and General Counsel of the Army, Subject: Army Arsenal Act," 4 Mar 1997.
26. Office of the Law Revision Counsel, U.S. House of Representatives, *10 U.S.C. Sec. 2687*, [Online] Available <http://uscode.house.gov/>, 22 Jan 2002.
27. Office of the Law Revision Counsel, U.S. House of Representatives, *10 U.S.C. Sec. 4532*, [Online] Available <http://uscode.house.gov/>, 22 Jan 2002.
28. Office of the Law Revision Counsel, U.S. House of Representatives, *10 U.S.C. Sec. 4542*, [Online] Available <http://uscode.house.gov/>, 22 Jan 2002.
29. Office of the Secretary of the Army, "Memorandum from Assistant Secretaries of the Army Susan Livingstone and Stephen K. Conner. Subject: Implementation of Statutory Authorities for Manufacturing by Army Industrial Facilities", 30 Jul 1992.
30. Peckenpaugh, Jason. "Defense Seeks Repeal on Limits on Outsourcing Depot Work," *Government Executive Magazine*, [Online] Available <http://www.govexec.com/news/indexcfm?mode=report&article=24710@printerfriendly.html>, 15 Jan 2003.

31. Response in E-mail Format to Request For Information by James Shields, Assistant Program Manager, Joint LW155, Picatinny Arsenal, New Jersey, from the author, 18 Jul 2003.
32. Response in E-mail Format to Request For Information by James Shields, Assistant Program Manager, Joint LW155, Picatinny Arsenal, New Jersey, from the author, 24 Jul 2003.
33. Response in E-mail Format to Request For Information by Robert Parise, Chief, ARDEC Legal Office, Picatinny Arsenal, New Jersey, from the author, 6 May 2003.
34. Responses in E-mail Format to Request For Information by Robert Parise, Chief, ARDEC Legal Office, Picatinny Arsenal, New Jersey, from the author, 18 Aug 2003.
35. TACOM-ARDEC Legal Office, "Memorandum for Deputy Program Officer, GCSS. Subject: Arsenal Act Implications," 13 Oct 1998.
36. Telephone Conversation between James Shields, Deputy Program Manager, XM777 Joint Lightweight Howitzer Program (LW155), Picatinny Arsenal, New Jersey, and the author, 22 Nov 2002.
37. Telephone Conversation between James Shields, Deputy Program Manager, XM777 Joint Lightweight Howitzer Program (LW155), Picatinny Arsenal, New Jersey, and the author, 26 Nov 2002.
38. Telephone Conversation between James Shields, Deputy Program Manager, XM777 Joint Lightweight Howitzer Program (LW155), Picatinny Arsenal, New Jersey, and the author, 02 May 2003.
39. Telephone Conversation between James Shields, Deputy Program Manager, XM777 Joint Lightweight Howitzer Program (LW155), Picatinny Arsenal, New Jersey, and the author, 20 Aug 03.
40. Telephone Conversation between Martin Kane, Business Manager, XM777 Joint Lightweight Howitzer Program (LW155), Picatinny Arsenal, New Jersey, and the author, 26 Nov 2002.

41. Telephone Conversation between Robert Parise, Chief, ARDEC Legal Office, Picatinny Arsenal, New Jersey, and the author, 2 Dec 2002.
42. U.S. Army Armament Research Development and Engineering Center (ARDEC), Legal Office, "Memorandum for PM Crusader, Subject: Stratton Amendment," 15 Oct 1998.
43. U.S. Army Industrial Operations Command, IOC Regulation 15-4, "Boards, Commissions, and Committees: Make or Buy Decisions," Rock Island, Illinois: 7 Jan 2000.
44. U.S. Army Office of the Deputy Chief of Staff for Operations and Plans, "Memorandum for Commanding General, U.S. Marine Corps Combat Development Command, Subject: Army Adoption of USMC Mission Needs Statement for a Lightweight 155mm Towed Howitzer (LW155)," 24 Sep 1994.
45. U.S. Army Regulation 700-90, *Army Industrial Base Process*, [Online] Available http://www.usapa.army.mil/series_range_pubs.asp?range=700, 3 Feb 2003
46. U.S. Army Tank-automotive and Armaments Command (TACOM) Ground Systems Industrial Enterprise (GSIE), "GSIE Overview Briefing," [Online] Available <http://www.gsie.army.mil/>, 24 Jan 2003.
47. U.S. Army Watervliet Arsenal. "About Watervliet Arsenal." <http://www.wva.army.mil/ABOUT.HTM>, 1 May 2002.
48. U.S. Congress, U.S. House of Representatives, *Making Appropriations for the Department of Defense for the Fiscal Year Ending September 30, 2000, and for Other Purposes Conference Report 106-371 to Accompany H.R. 2561*, [Online] Available [http://www.congress.gov/cgi-bin/cpquery/R?cp106:FLD010:@1\(hr371\)](http://www.congress.gov/cgi-bin/cpquery/R?cp106:FLD010:@1(hr371)) :, U.S. Congress, 2000.

49. U.S. Court of Appeals for the Fourth Circuit, *Lewis Machine and Tool Company v. United States Department of Defense*. Case No. 97-1035, Lexis 27249. [Online] Available. http://web.lexis-nexis.com/universe/document?_m=22f5c7f95a7cc25d46b4bce420103932&_docnum=6&wchp=dGLbVtb-1SlAl&_md5=195d06acc8372f9499559c381a31f128. Decided 6 Oct 1997.
50. U.S. Court of Appeals for the Seventh Circuit, *AFGE, Local 2119 et al. v. Donald Rumsfield, et. al.* Case No. 00-3512. Decided 21 Aug 2001.
51. U.S. District Court for the Central District of Illinois, *AFGE, Local 2119 et al. v. William S. Cohen, Secretary of Defense, et al., and General Dynamics Land Systems, Inc.* Case No. 97-4020, [Online] Available http://www.afge.org/Documents/SWAMPLegal/rockisland_cdill_decision.pdf. Decided 23 Aug 2000.
52. U.S. District Court for the Eastern District of Virginia, Alexandria Division, *Lewis Machine and Tool Co. v. The United States Department of Defense*. Civil Action No. 96-1275-A. Decided 22 Nov 1996.
53. U.S. Marine Corps Combat Development Command, "Memorandum for Commanding General, Subject: Mission Need Statement (MNS) for A Lightweight 155mm Towed Howitzer (LW155)(No. SPA 212.1.1," 27 May 1993.
54. Williams, Robert H., "Readiness Pledge by Pentagon Prompts Challenge from Congressional Leader," *National Defense*. Jul/Aug 1997.
55. Womack, James P. and Jones, Daniel T., *Lean Thinking: Banish Waste and Create Wealth in Your Corporation*, Simon & Schuster, 1996.

INITIAL DISTRIBUTION LIST

1. Defense Technical Information Center
Ft. Belvoir, VA
2. Dudley Knox Library
Naval Postgraduate School
Monterey, CA
3. Department of the Army
Joint Program Office, LW155
ATTN: Mr. Jim Shields
Picatinny Arsenal, NJ
4. Department of the Army
ARDEC-Legal Office
ATTN: Mr. Robert Parise
Picatinny Arsenal, NJ
5. Professor David F. Matthews
Naval Postgraduate School
Monterey, CA
6. Dr. Raymond E. Franck
Naval Postgraduate School
Monterey, CA
7. Professor Brad R. Naegle
Naval Postgraduate School
Monterey, CA
8. Dr. David Lamm
Naval Postgraduate School
Monterey, CA